D2.2 Mapping of EU cloud services, solutions technological readiness

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This document introduces an innovative concept, “Market Readiness Levels”, as a complementary methodology to “Technology Readiness Levels” as instruments for project preparation and project review. Initially targeting EC-funded projects (under H2020) it is designed to be used in commercial contexts as well.

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CloudWATCH2 Mission

It is only when the innovation process is inclusive and open that we truly advance technology for humanity – from small businesses to public sector organisations and citizens as the new digital consumers. The use of open source software and open standards are becoming increasingly seen as enablers and levellers for public and private sectors alike, bundling skills to create new services and applications.

CloudWATCH2 takes a pragmatic approach to market uptake and sustainable competitiveness for wider uptake and commercial exploitation. It provides a set of services to help European R&I initiatives capture the value proposition and business case as key to boosting the European economy.

CloudWATCH2 services include:

- A cloud market structure roadmap with transparent pricing to enable R&I projects to chart exploitation paths in ways they had not previously considered, or help them avoid approaches that would not have been successful.
- Mapping the EU cloud ecosystem of products, services and solutions emerging from EU R&I projects. Identifying software champions and best practices in mitigating risks associated with open source projects, and ultimately, enable faster time-to-value and commercialisation.
- Impact meetings for clustering and convergence on common themes and challenges. Re-use of technologies will also be of paramount importance.
- Promoting trusted & secure services through roadshows and deep dive training sessions. Giving R&I initiatives a route to users at major conferences or in local ICT clusters.
- A portfolio of standards for interoperability and security that can facilitate the realisation of an ecosystem of interoperable services for Europe.
- Cloud interoperability testing in an international developer-oriented and hands-on environment. Findings will be transferred into guidance documents and standards.
- Risk management and legal guides to the cloud for private and public organisations to lower barriers and ensure a trusted European cloud market.
- Legal guidelines to the cloud for SMEs containing practical examples of cloud contracts' clauses that need to be assessed before purchasing cloud services.

Disclaimer

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Executive Summary

There is a need for Research & Innovation ("R&I") outputs to be useful, usable and used. This deliverable describes how to fulfil that need with a new project support method. This method has been validated in a closed environment with 4 existing grant-funded R&I projects.

In April 2016, at the Net Futures conference in Brussels, CloudWATCH2 led a workshop on sustainability and exploitation for projects within the EC cloud clusters[1] as part of its concertation efforts. There was very high engagement with the topic, largely driven by the need for expert input to project exploitation and sustainability planning, and better resource sharing within clusters.

By September 2016, CloudWATCH2 responded to this need by developing a new project support method based on combining a well-understood measure of technology maturity, "Technology Readiness Levels" with newly defined "Market Readiness Levels". In October 2016, after an independent expert, Frank Bennett, iCloud, developed this method based on the needs of CloudWATCH2, the method was refined and successfully trialled with 3 other projects within the cloud computing, software and IoT clusters.

Combining the business model canvas, the output of a business model generation method that has wide acceptance including among projects referenced in this report, with a method to assess market readiness introduced by the independent expert, it was possible to develop the project support method used to assist the trial projects referred to herein.

There is a clear need to increase the sustainability of grant-funded R&I projects, ensuring the outputs of these projects are taken up by their constituent stakeholders, users or customer groups. The proposed project support method can be implemented at various stages within the grant lifecycle, but is most relevant at the planning stage, 3 months before annual project reviews to identify corrective actions ahead of time and 6 months before the end with a go-to-market plan.

Against shrinking budgets, the desire to remain competitive through technological excellence and a vision for a European Digital Single Market underpinned by the exploitation of 'home grown' research and innovation, this new project support method directly enables R&I sustainability. This method can be rolled out across EC technology clusters with smart use of existing resources and will open up a new, practical method to sustain the outputs of existing and future R&I projects.

[1] https://eucloudclusters.wordpress.com/

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1 Introduction

The CloudWATCH2 project set out to "Support market uptake of EU R&I cloud services" as a joint effort of WP2 (Concertation, clustering and Convergence) and WP4 (Communication, Engagement and Market Structure Roadmapping)[2]. This deliverable describes the activities and initial results of this joint action between WP2 and WP4. As per project plan, this activity will evolve over the second half of the project, and improvements are scheduled to be published with Deliverable D2.4 (due September 2017).

The EC programmes FP7, and even more so the H2020, call for consortia to conduct research and innovation, in combined as well as in separate funding calls, for the improvement of existing systems (innovation) or the discovery of new systems, approaches and knowledge (research).

Whichever the topic of a project, the most important aspects are its outputs and their respective impacts that live on beyond the project's lifetime. Two major factors threaten any project's legacy:

- The technology is not ready (yet) for production, or
- Potential adopters are not aware of the new or improved technology

Although frequently cited as a critical factor, correct timing (or rather, the lack of it) is a result of these two fundamental factors, and the lack of foresight attached to these. When planning for productising project output, a fair amount of lead in time is necessary before a product or service is launched in the market. To plan market introduction and operations, a future projection of the product or service's maturity is necessary.

The concept of technology readiness levels is very well understood: Many different definitions exist as they are adapted to the sector's context. Yet they follow the same principal purpose of capturing and modelling the maturity of technology from inception to full production operations, indicating the technology's progress using an integer scale. Beginning with "0", which denotes a mere intellectual idea, technology readiness progresses until it reaches Technology Readiness Level "9", which describes a technology's full operational deployment. Several popular definitions exist, ranging from space exploration (NASA[3] & ESA[4]), to public authority definitions (UK MoD[5]) and the European Commission itself in Annex G to the H2020 programme[6], to name but a few.

However, technology readiness regards only one aspect of product development towards inclusion in the operative business of an organisation. Successful product development (including service development) requires just as much effort and activity in the supporting and surrounding services and business processes, such as business strategy, business modelling, marketing, sales, after-sales support, service desks, IT service management systems, supply chain management, staff training and education, business change and transition, just to name a few.

Just as technology must be ready for market entry, each and any of the applicable support systems and processes need to be in place before a product can be sold, or a service offered to customers and clients. We model the maturing process of these support services and processes as "Market Readiness Levels (MRL)". Staying in an intuitive and easy to understand model, we define MRLs from "0" to "9" (see below).

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[2] http://www.cloudwatchhub.eu/cloudwatch2-think-cloud-services-government-business-and-research-0
[3] http://www.nasa.gov/directorates/heo/scan/engineering/technology/txt_accordion1.html
[4] http://sci.esa.int/sci-ft/50124-technology-readiness-level/
[5] http://www.publications.parliament.uk/pa/cm201011/cmselect/cmsctech/619/61913.htm
[6] https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-g-trl_en.pdf

The concept behind both definitions is the same: Both TRL and MRL communicate on a high abstraction level the current status, as well as a future desired goal. It is important to keep the following design goals in mind:

- Readiness Levels (RL) must be contextualised into the application domain.
- RL do not imply constraints on the size or complexity of the product/service
- RL do not impose a level of maturity or perfection of the assessed domain.
- RL are orthogonal to project management paradigms (such as Agile, Lean, or Six Sigma)

Having these design goals in mind, Readiness Levels do not operate in the void; they are always embedded in business strategy, business roadmaps, and milestones.

The CloudWATCH2 project therefore will not analyse technology readiness and technology maturity of EC funded projects alone, it will combine it with an equally important market readiness level assessment, as described in subsequent sections of this document.

Regardless of its funding streams, engaging with projects to assess readiness levels and to give recommendations inevitably relies on a trusting relationship between the project members and the experts. The reasons for this are manifold, be it that experts potentially touch sensitive and sore points of contention and conflict in a project, or that recommendations given should be considered as business intelligence with the potential of providing an advantage over potential competitors. In any case, CloudWATCH2 promised confidentiality of the outcomes to the volunteering projects, unless written permission would allow CloudWATCH2 to publish the results.

At the time of writing, CloudWATCH2 has not received permission from any of the assessed projects for disclosing publicly the results. Therefore, this public deliverable will stop short of full disclosure and only provide information of generalised nature. CloudWATCH2 was however permitted to include some confidential information in its Year 1 review with the commission and the reviewing experts, since EC project reviews are confidential by nature.

Section 2 provides a description of the initial concept of Market Readiness Levels, and the underlying concept and best practices used for market introduction of a product or service. MRL are a new concept, and the concept itself requires iteration and improvement over time. However, the first version is described in this document; its usefulness has been demonstrated in practice with three exemplar EC-funded projects, and improvements in the framework and concept will be described in the future.

Section 3 will delve into the methodology and process of working with clients of this service. In verifying this novel approach of combining TRL with MRL, section 2 can be seen as describing the technical readiness level of the MRL framework itself, whereas section 3 covers aspects of market readiness of our approach: How are we engaging with clients, how do we research and analyse, which other methodologies do we employ, which skillsets are necessary, and how do we deliver the message?

Section 4 gives an overview of the results of CloudWATCH2 experts testing the novel approach together with three friendly volunteer projects. As indicated above, this deliverable in this section will not provide details of the individual assessments, which the project representatives decided to keep confidential, but a synthesis of transferrable experience on the side of our experts and the methodology itself.

The deliverable concludes with section 5 and 6 enumerating on our experiences, and potential avenues of improvement to pursue in year 2 of the CloudWATCH2 project.

2 Readiness for Market: More than completing software development

Within the context of sustainability and exploitation, we define 'Market Readiness' as being ready to go to market with *useful, useable and used* outputs. Whilst the purpose of achieving 'market readiness' is to develop a commercial offering for a group of customers, the concept can be successfully applied to developing a service offering for a group of users or stakeholders.

The activity to develop a story for Market Readiness is a journey that is under periodic review as with the progress of development and elevation of TRL. It is a difficult undertaking for a project to self-examine and self-determine "Market Readiness" as that process can be contaminated by hubris and therefore it is all the better as a facilitated process by an external party to bring objectivity to the outcome.

2.1 A brief refresher on Technology Readiness Levels (TRL)

EC Projects traditionally focus on the advancement of technical maturity of the topic at hand. This is a natural consequence of FP7 and also H2020 offering calls themed as "Research" (RA), "Innovation" (IA) or "Research and Innovation" (RIA) actions, along at times with "Coordination and Support Action" (CSA). With RA, IA and RIA consuming the largest amount of funds available in either programme, TRL are naturally an important measure of progress for EC funded projects. However, with H2020 raising the importance of exploitation and market introduction of project outputs, TRL should no longer be the sole means of measuring project progress.

In this context, we consider it important to briefly reiterate concept and context of Technology Readiness Levels. The very existence and inclusion of a definition of Technology Readiness Levels in Annex G of the H2020 programme's call documentation emphasises the importance of TRLs to the European Commission.

For the purpose of the methodology our definition of Technology Readiness Levels is as follows:

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 tests completed; proof of concept.	
4	**Small scale prototype.** Built in a laboratory environment ("ugly" 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 operational environment at pre-commercial scale.	

8	**First of a kind commercial system.** Manufacturing issues solved.	Production
9	**Full commercial application.** Technology generally available for all consumers.	

Table 1: Technology Readiness Levels as adapted by the CloudWATCH2 project

Compared to the definition of TRL in the H2020 Annex G, this version puts up a slightly higher barrier on technology maturity in that it emphasises on technology validation closer to the market on TRLs 6 and 7.

The reasoning behind this is two-fold. Firstly, to put more emphasis on and differentiate more between Research (TRL 0 – 3) and Innovation (TRL 4 – 5), and align with the H2020 SME Instrument's requirement for technology to be at TRL 6 or better[7]. Secondly, to recognise industry's need of mature technology which is easier and quicker to develop for market entry. This in turn lowers the cost of implementing a go to market strategy.

2.2 Market Readiness Level (MRL) building block 1: Business Model Canvases (BMC)

MRLs visualise the work performed behind the scenes. A cornerstone of that underpinning work comprises developing a business plan for the medium and long-term future. However, before a business plan can be developed and eventually enacted, the key mechanics of the product or service brought to market needs to be understood by all involved stakeholders: The business model.

A business model is an "abstract representation of an organization, be it conceptual, textual, and/or graphical, of all core interrelated architectural, co-operational, and financial arrangements designed and developed by an organization presently and in the future, as well as all core products and/or services the organization offers, or will offer, based on these arrangements that are needed to achieve its strategic goals and objectives."[8] For this reason, it is the first milestone and a top of agenda item for the first meeting between the project studied and CW2 and is kept under review.

The business model evolves and its first iteration may be skeletal and challenging to build. This is usual and external facilitation of the build breaks through a lack of understanding of the process and reservation to confess to what is unknown. This is all part of developing a common understanding of the value proposition and what is component (known as building blocks) to it.

The canvas when populated is a blueprint for a strategy that has many moving parts (9 building blocks) that have discrete activities, yet is cognisant of their interconnection to delivery of the value. The BMC building blocks focus on the and operational mechanics of a product or service offered by a provider. When completed, it provides a complete and concise overview of a business model on a single page: The canvas. Key to the success of a business, however, is the value provided by that product or service. Without a realistic and accurate value proposition, the business model captured in the BMC will not get into motion. Hence the relationship between the BMC building blocks "Value Propositions" and "Customer Segments" are captured in a breakout document: The "Value Proposition Canvas" (VPC, not shown in this deliverable). Together, the BMC and VPC allow any organisation to validate their business proposal, organisational structure, and allocation of resources. If there is no business canvas[9] at the outset then it is more difficult to develop later when a 'shoehorn' is attempted to reconcile alignment of resources.

[7] https://ec.europa.eu/digital-single-market/en/sme-instrument-frequently-asked-questions

[8] *Al-Debei, M. M., El-Haddadeh, R., & Avison, D. (2008). "Defining the business model in the new world of digital business." In Proceedings of the Americas Conference on Information Systems (AMCIS) (Vol. 2008, pp. 1-11)*

[9] https://strategyzer.com/canvas/business-model-canvas

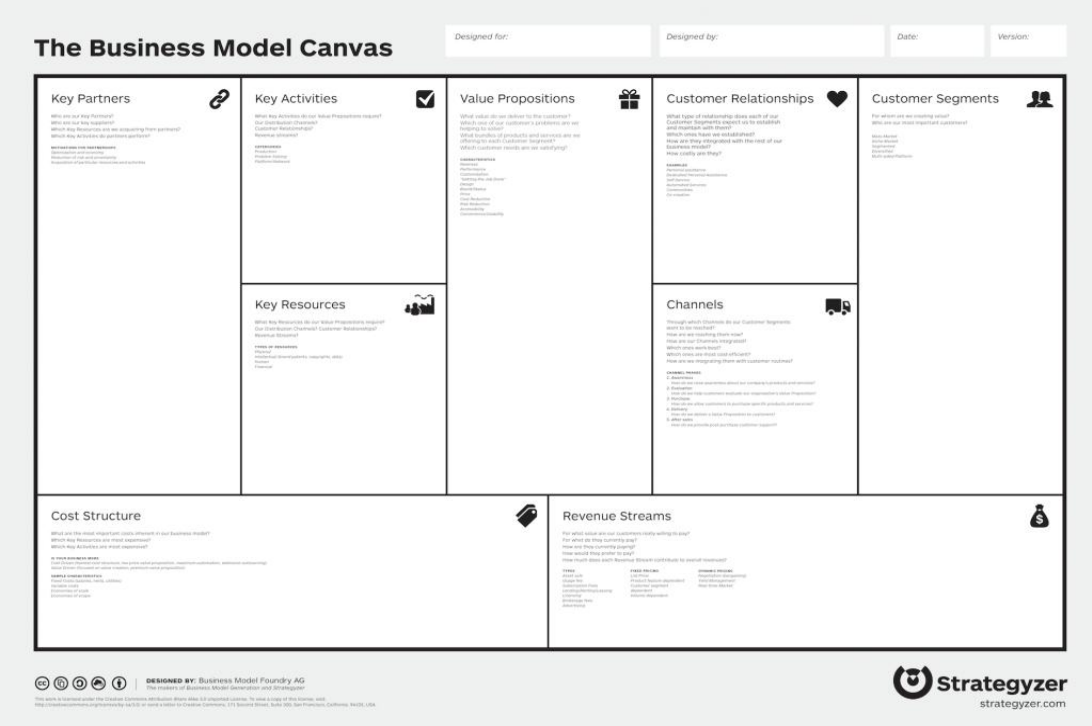


Figure 1: The Business Model Canvas as defined by Strategyzer

The key milestones of business modelling are:

1. Do it at the outset of a project and engage creators and co-workers.
2. Engage a suitably qualified and experienced person to facilitate the initial build of the business canvas.
3. The business canvas is a living document and should be regularly reviewed to take account of progress and external factors that disrupt or enhance the value. Think about it as your 'business pitch' and the story it tells to your customers, partners, stakeholders, investors and anyone else asking the question; what is your value? When you learn something from these conversations that is important to the value, record it in the business canvas.
4. Over time it is usual to become fluent using the business canvas and presenting it and where gaps in knowledge exist subject matter experts should be sought. External facilitation during a review is useful to expose blind spots and identify gaps in knowledge.
5. The business model canvas is a mirror for the MRL and a reference point to validate the MRL. Therefore, it is important that the business model canvas reflects the MRL and that requires it to be kept under review (points 3 and 4 above)

2.3 MRL building block 2: The four Fits model

As part of modelling Market Readiness, we use a model of "four fits" when implementing commercial operations to describe discrete stages and milestones in the process of enacting a go to market strategy. These four stages are defined as follows:

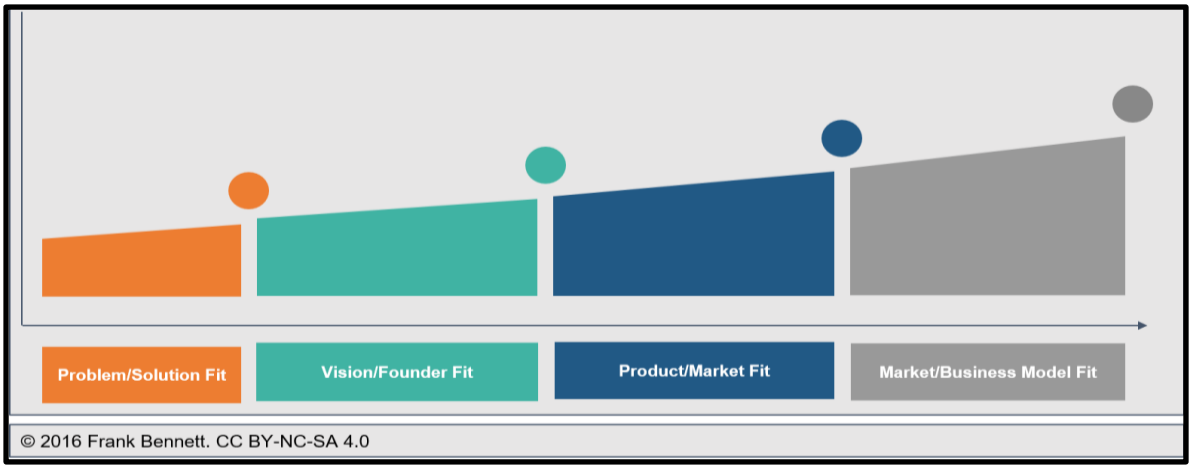


Figure 2: The four fits model for commercial operations

Problem/Solution Fit

"Does the problem exist? Can we solve it? Are we 'improving' or 'creating new'?"

First, a project must have clarity of purpose. They must articulate the problem clearly, propose a solution and demonstrate the viability of a proposed solution. This stage of development is best characterised by a period of intense research, gathering evidence through interviewing stakeholders affected by the problem and early-stage designs for a solution that addresses a clear set of needs and in some cases that may be vague and lend itself to co-creation.

Vision/Team Fit

"Do we have the right team to solve the problem?"

Second, a project must have an effective team. Strong project leadership depends on clarity of purpose, an understanding of the required skill sets (which should be complementary), the ability to communicate and motivate a team of suitably qualified individuals and a demonstrable track record in leadership. The quality of a project's outputs or service offering is only as good as the team behind it.

Product/Market Fit

"Is my product desirable? Is it the right target market?"

Third, a project must move ever closer to matching its service offering, solutions or outputs to best serve the needs of its constituencies of customers, users or stakeholders. The TRL/MRL is perfectly aligned to support the reality of converging the development activity with an understanding of how that will address the target market where the market is ripe with innovation and a moving target.

Market/Business Model Fit

"Do we understand the model for exploitation and sustainability?"

The TRL/MRL plots the progress and trajectory to market entry. Behind the scenes is work to develop an understanding of the dynamics of go-to-market and the framework to develop that understanding is the business model canvas. This is a well-known method that engages potentially everyone in a project, this is raw thinking time and should be facilitated by a competent person familiar with the process of developing a business model canvas and who brings objectivity to the process. This is not the time for fanciful ideas as it informs the vital activities aligned to the evolution of MRL over time, for example; who do we need as partners and why? The partners needed at the outset of a project when development is in focus typically change as the project assembles its go-to-market plan.

2.4 Market Readiness Levels

With building blocks in place, we can now define Market Readiness Levels within their proper context:

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.** *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 2: Market Readiness Levels. © 2016 Frank Bennett

Market Readiness Levels inherit their scale from Technology Readiness Levels, 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.

The "Four Fits Model" applies to the last four MRL only: Everything prior to actual revenue is considered preparation for market entry, and only legitimate sales based on contracts[10] are taken as evidence for reaching these milestones.

Figure 2 illustrates the typically increasing challenge of creating a sustainable commercial operation: Achieving the Business Model/Market Fit is much harder than demonstrating mastering the Problem/Solution Fit.

2.5 Putting it all together

The key innovative concept described in this deliverable combines assessing EC H2020 projects not only according to the definition of TRL, but also in combination with the new concept of Market Readiness Levels, as a direct response to the EC's increased focus on project output exploitation and commercialisation (c.f. relevant proposal assessment annexes to the H2020 programme).

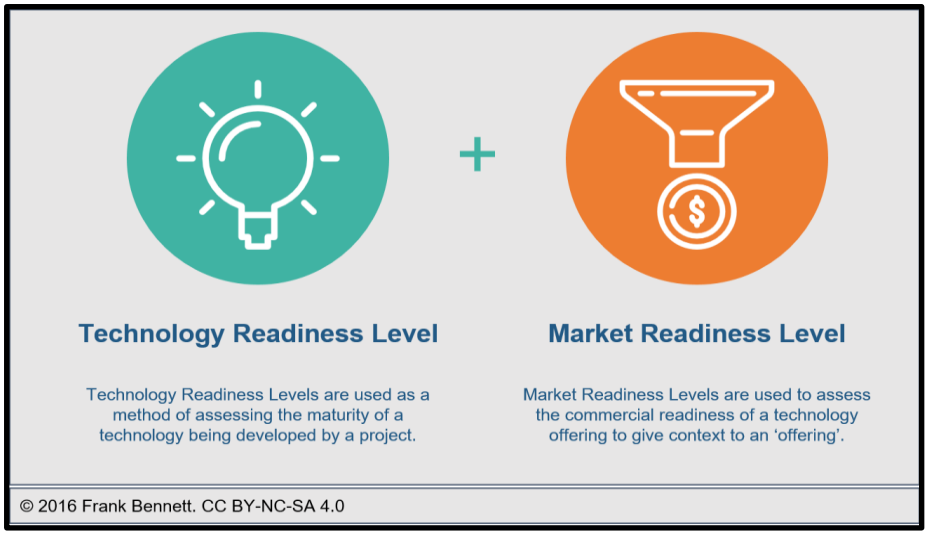


Figure 3: A holistic readiness assessment of EC H2020 projects

This approach includes a powerful visualisation technique that can be used twofold.

Used as a **project assessment element**, it allows reviewers to award a two-dimensional scoring at the current state of the project. For example, an assessment may result in a "5:4" score indicating that the project is currently in possession of a large-scape prototype (TRL 5) that is (or may be) tested in a small-scale stakeholder campaign (MRL 4). Further, reviewers can indicate a *future potential* for the project as they distilled it from the information available to them at the time of the review (see Figure 4). In essence, this technique allows reviewers to change from the very usual and common "benchmarking the past" type of review that almost inevitably results in focussing on what has *not* been achieved (negative slant), to focussing on the positive, the opportunities of a project, on its *potential*.

[10] Note that some types of sales include implicit contracts, such as those including online payments using debit or credit cards, direct-debit sales, etc.

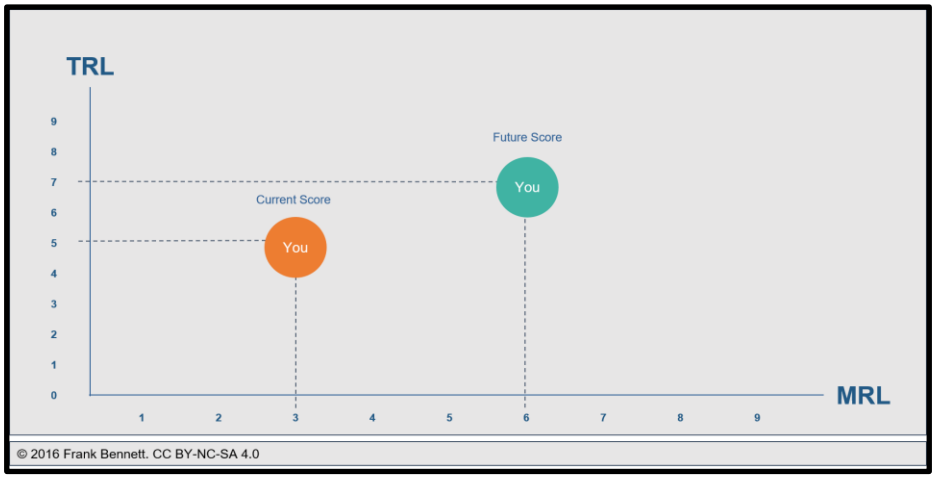


Figure 4: Current score and future potential in TRL:MRL scores

The second no less important use of TRL:MRL scores is geared towards **project proposal preparation**. Instead of being used to benchmark projects in a review style, project planners can use it as a *strategy visualisation tool* to plan the future in the project. Just as much as two key data points (the current, and the future desired score) are important, the *trajectory*, or journey, is a key element of project management and business change management. By indicating the current and planned final score, together with the desired trajectory during the project lifetime, project planners have a much more detailed view and strutting in place to explain to funders their *project implementation strategy.*

3 Project review and results delivery methodology

Just as much as the technical building blocks contribute to the shape and success of an innovative concept, methodology and delivery of the service and the results are key factors in the performance and fitness for purpose of the offering.

The first building block of service delivery lies in the diversity of the review team – in this case the three authors of this deliverable. With Frank Bennett, iCloud & external expert representing business modelling and business development, Frank Khan Sullivan, Strategic Blue for marketing and sales, and Michel Drescher, University of Oxford for technology and innovation, the review team provides three complementary fields of expertise to draw specific recommendations for the reviewed projects.

The second building block are the self-selected EC projects from a pool of invitations sent to the CloudWATCH2 concertation mailing list in preparation for the workshop and this accompanying deliverable. By filling out a questionnaire shaped as a request for initial information (see section 8) projects signalled their interest and need (c.f. to business model canvas and value proposition canvas described earlier) of advice and review.

The third building block comprises of the review methodology described in this section. Essentially, the methodology comprises of four phases described in more detail below:

No.	Name	Description
1	Request for Information (RFI)	Gather initial information from projects in consistent form

2	Independent research	Deepen understanding of the project and its landscape and context
3	Reviewer workshop	Reviewers share information and discuss recommendations
4	Delivering the review	Joint workshop with the project representatives

Table 3: Reviewing projects and delivering recommendations in a consistent manner

3.1 Phase 1: Request for Information (RFI)

Requests for Information are sent to projects in a consistent manner, as a link to a Google Form capturing the responses, which the form then automatically saves in a Google Spreadsheet. We decided to use the Google Docs system as a highly collaborative content sharing environment, on the basis of a commercial subscription of one of the reviewers, which include sufficient data protection and privacy T&Cs compared to the free of charge use of the same service.

The RFI intentionally asks for high-level detail to put the responder into a situation similar to an "elevator pitch" opportunity: Which of the information I could relay is actually the most interesting one? Which piques the interest, or summarises the added value the best? Similar to studies on social and behavioural patterns, the first impression made in a very short time is most important in shaping the initial opinion and future business relationship between you and the recipient, hence the elevator pitch approach.

Section 8 provides the RFI form in a tabular form, including the link to the actual online form (but not the responses).

3.2 Phase 2 Independent research

All reviewers undertook independent research on each project presented in the respective RFIs; however, reviewers agreed a common working method:

- Review all documentation provided;
- Scout the project website;
- Follow-up on provided links.

Beyond this, reviewers were free in their choice of methodology and encouraged to apply further individual research, for example competitor searches, supplier matches, collaboration opportunities, market analysis, project sentiment analysis through social media, technology reviews and many more.

This phase aims at collecting as much information as possible, from a diverse range of gathering techniques as individually available to the reviewers based on their experience and professional career.

At this point, information was *not* shared, so as to prevent bias and priming of reviewers by information available from the others.

3.3 Phase 3 Reviewer workshop

Once all reviewers indicated that they concluded their individual research, the team conducted a full-day internal workshop.

Firstly, reviewers discussed their individual findings and shared their research sources and material with the goal of achieving a common mind-set about the projects. This was conducted in all openness and honesty, with reviewers requesting additional information and clarification from each other, or outright challenging findings seemingly contradicting one's own. The scope of research and discussion was explicitly not limited

to the project's current state and assets, but in accordance with the TRL/MRL combination looking to the future and examining the project's potential in the way that one would ahead of preparing for market entry.

After this initial round of information sharing and mind-setting, each reviewer made their judgement call on the TRL/MRL scores (current and future potential) for each project. This second phase of the reviewer workshop was conducted by adapting a very successful technique originating from the Agile Project Management framework SCRUM, which is called "planning poker".[11]

In short, planning poker helps a team to build common understanding, consensus, and shared commitment to that consensus. Where planning poker uses "story points" to describe the complexity and effort to accomplish the work described by a user story, the reviewers substituted the user story with the TRL and MRL, and the story points with the assigned readiness level. Using planning poker's iteration basis, reviewers further argued and explained their TRL/MRL judgement calls until consensus was reached and all reviewers committed to that consensus. This, however, was not possible for the MUSA project, and the process was terminated in that case by agreement to disagree.

As an intended corollary of this planning poker style project scoring phase, reviewers also discussed and converged onto recommendations that may help the projects to alleviate identified gaps and/or reach the potential summarised in the future TRL/MRL score also assigned during that phase.

Subsequently, each project was assigned a lead reviewer to create a summary slide deck for presentation and discussion with the project team. To achieve consistency, a template slide deck was used to capture the review material and recommendations (see Figure 5 below). Recommendations were wide and varied, including developing customer personas, analysing different business models for different stakeholders, identifying and reflecting on existing resource constraints, and alleviating skill gaps that would profit the advancement of the project's MRL.

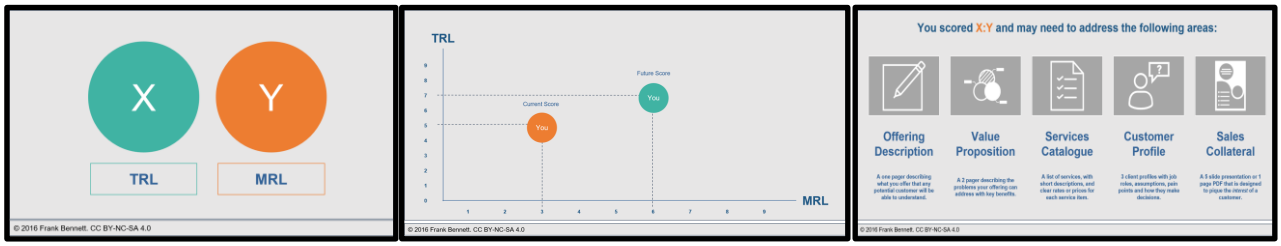


Figure 5: Core template set of review delivery slides.

3.4 Phase 4 Delivering the review

The actual delivery of the scores and the related recommendations were embedded in a workshop held at the CloudForward 2016 conference.[12]

This workshop included a public and open introduction to the framework described in this document, where the reviewers also discussed with participants, among other topics, the applicability of the methodology to H2020 project preparation (see section 5 for more details).

Due to time restrictions (in fact, the introduction session piqued much more interest than anticipated) the review team decided to go against the initial plan to deliver the review as a team to each project sequentially. Instead, it was agreed with the projects to deliver the results in parallel, with each lead

[11] https://en.wikipedia.org/wiki/Planning_poker
[12] http://cf2016.holacloud.eu/smes-event/workshop/

reviewer joining the respective project representative(s). Each delivery session had a duration of approximately 30 – 60 minutes, depending on the project representatives' needs.

Firstly, the lead reviewers walked the representatives through the findings and assigned TRL/MRLs, explaining how and why the review team arrived at these scores, and the context and background of specific recommendations made. This then led to conversations very similar to those in the reviewer workshop, clarifying and contextualising the findings, and how projects at times arrived at the same conclusions. In one instance, these conversations led to the revision of the current TRL to a higher value, agreed by all reviewers, in light of the information provided by the project representatives.

4 High-level summary of results

To elicit candidate projects for an assessment of their technology and market readiness, we reached out to the existing and established network of projects maintained by CW2 Task 2.1 through the concertation meetings and mailing list. Three projects showed interest in receiving an assessment and recommendations for their future course.

The remainder of this section will describe high-level results achieved through working with the three projects. Since specific information and recommendations are kept confidential, we are not able to present these in this document. However, since the assessments took place prior to and at the CloudForward 2016 conference in the week before the Year 1 review of the CloudWATCH2 project was scheduled, we were able to relay some information to the Project Officer and reviewers under the confidentiality clauses of EC H2020 project review meetings.

4.1 CloudTeams

CloudTeams is a crowdsourcing platform that connects software developers with software testers. This project addresses two main problems in the European software market: finding matching users to validate software features early in the development cycle and reducing the overall cost of testing. This is a 2-year project finishing around February 2017. CloudTeams was assigned a Technology Readiness Score of "4" and a Market Readiness Level of "4" due to the fact that it had not launched its beta yet. We anticipate a rapid increase in both technology and market readiness upon launch, with projected scores of "6" or "7" in both categories due to their strong planning and ability to execute.

Two of CloudTeams' project leaders joined the workshop to discuss key recommendations to elaborate on new commercial stakeholder groups which we identified, a demand generation model we provided that would drive signups through their website, specific advice on licensing models to create revenue streams supporting the project's sustainability objectives, refining their value proposition to include in-house developers within a large organisation as well as external software development providers, and a go-to-market strategy that targeted such potential users.

CloudTeams has demonstrated exemplary progress and collaboration, and with the right support in connecting a community of software development projects to a sufficiently diverse and engaged community of testers, it is likely that CloudTeams may progress quickly through several Technology & Market Readiness levels over the coming months with their launch. As agreed with CloudTeams, we will reconnect in December 2016 to assess progress against objectives.

4.2 MUSA: Multi-Cloud Secure Applications

MUSA is an ambitious project to develop solutions for what is arguably the hottest area of tech development today, information security. MUSA is developing a framework for businesses deploying distributed applications over heterogeneous cloud resources. There are known risks and this is an area attracting massive investment in response to those risks, on November 1st 2016 the UK announced a £1.9Bn investment to support its National Cyber Security Strategy 2016-21 to combat cybercrime https://www.gov.uk/government/news/britains-cyber-security-bolstered-by-world-class-strategy

The Regulation (EU) 2016/679 (EU General Data Protection Regulation or simply GDPR) entered into force earlier this year and will start applying from May 2018. Pursuant to Article 3 of the GDPR, every business and organisation located in the European Union or providing goods or services to subjects located in the European Union will need to comply with the GDPR or risk facing substantial financial penalties (up to €20 million or 4% of global annual turnover for the preceding financial year, whichever is the greater). The rapid adoption of cloud services has not always been accompanied by rigorous evaluation of the assurance of those services. This directly feeds the process of evaluation of risk that is required of good governance.

MUSA had prior to our meeting at the CloudWATCH2 workshop a project review with their project officer that had resulted in decisions that were aligned with the recommendations reached by the independent team reviewing the MUSA project and presented at the workshop.

The recommendations were developed after reviewing the information provided by MUSA in a pre-workshop RFI, evaluation of the information on MUSA website and reviewing sources of information of others that have a similar technological focus to solving security in the way that MUSA describe (see above). The search revealed some interesting differences in the approaches taken to describe the problem/solution and the language used in those descriptions that were included in the recommendations to MUSA.

The main benefits to the project as relayed during the workshop are:

1. Independent confirmation of the decisions reached during the official project review, e.g. focusing the exploitation efforts on only part of the tools in the MUSA framework.
2. Guidance on how to build on the experience of business model generation and put that in the focus of TRL/MRL to have point in time assessment and develop a trajectory for the reassessment of the TRL/MRL leading up to product release.
3. Website and content maintenance is often underestimated with the involved team often battling to keep the oversight. An independent external assessment brings to the attention the actual conveyed message as opposed to the intended takeaway in scenarios where external communications activities are under budgeted.

There are no hard follow actions. The project has an end date of December 2017 and is now set on a new course following its last project review.

4.3 WAZIUP: Open IoT and Big Data platform, from Africans for Africans

Undeniably, IoT and Cloud are complementary paradigms and can improve each other's performance and use when combined appropriately. The WAZIUP project combines both with the third ingredient unequivocally needed in this context: BigData. IoT devices, certainly when deployed on a large scale, can produce BigData which needs to be handled accordingly. Characterised using *the four Vs* "Velocity", "Volume", "Veracity" and "Variability", any combination of these characteristics requires an appropriate IT infrastructure to handle the data. Cloud-based infrastructures are the right choice of means.

WAZIUP aims to develop and provide a cloud platform (a PaaS solution) offering SMEs an environment to develop BigData and IoT solutions. The project's intention is to engage African SMEs to develop solutions for the African market, particularly rural environments.

WAZIUP started in February 2016 and will end in January 2019.

WAZIUP integrates a number of key components that already exist in production with supporting communities (TRL9), but binds itself to a relatively young and new platform that still needs to find and demonstrate its own sustainability. Regardless, the platform itself does exist as a current lab prototype and awaits its use and deployment "in the field".

WAZIUP partners include PAs and NGOs from African countries, who form the direct liaison to the target sector, the SMEs developing and producing the solutions, and the villages in rural Africa who would consume these solutions. A plethora of use cases (user stories) exists, and WAZIUP selected five key use cases for trailblazing and validation.

We assigned the following scores to the WAZIUP project: TRL 4 and MRL 3.5

Although one might consider it a low scoring, it reflects the projects' current state, which is in line with its own plan.

Recommendations included the following summarised points. WAZIUP has an unusually diverse set of (potential) stakeholders that may be grouped into clusters with quite different potential business models and agendas. It is important for WAZIUP to develop the stakeholder personas and produce piquing material tailored to each of these groups. Likewise, different stakeholder groups (where concerned as product/service providers) may provide different services and thus need to develop different service catalogues - by trailblazing through publishing blueprint service catalogues may cause faster uptake and traction in the market.

A number of specific recommendations were made related to connection and networking, to support and synergise in the areas of hardware development and software development, as well as a number of high potential funding stakeholders were recommended.

Incorporating recommendations from the CloudWATCH2 year 1 review, we will follow up with the WAZIUP project to see where support with the Common Exploitation Booster[13] may be needed.

5 Conclusions

Using a concept developed outside the project, CloudWATCH2 has taken the notion of Market Readiness Level to the entire portfolio of software and cloud-related projects funded through the H2020 programme, managed by DG CNECT Unit E.2.

While the concept of Technology Readiness Levels (TRL) is widely known among project partners (organisations) and members (personnel), Market Readiness Levels (MRL) are entirely new. Yet, participants in the public workshop and pursuant closed doors assessment of the projects CloudTeams, MUSA and WAZIUP grasped the idea intuitively, immediately developing an understanding of both the concept and underpinning frameworks, as well as the consequential need for action within the scope of their respective projects.

[13] http://exploitation.meta-group.com/Pagine/About-Us.aspx

5.1 Go to market strategy and project proposals

The suggested concept of Market Readiness Levels along with underpinning frameworks is anticipated to be most effective in the latter phases of a project when the decision is made to develop a go to market strategy. However, assessing a project's MRL at the *beginning,* even during the project proposal development phase. can provide vital information on the value of the proposal, either to decide to abandon the considerable effort to put a project proposal together, or to highlight the proposal's strength right from the start using an accepted methodology.

Particularly helpful in this phase of any project is the strong correlation of project fitness (2.3) with various sections of the H2020 project proposal template:[14]

Proposal template sections	Project fitness model
1. Excellence 1.1 Objectives 1.2 Relation to the work programme 1.3 Concept and approach 1.4 Ambition	Problem / Solution Fit
2. Impact 2.1 Expected impacts 2.2 Measures to maximise impact a) Dissemination and exploitation of results b) Communication activities	Product / Market Fit Business Model / Market Fit
3. Implementation 3.1 Work plan — Work packages, deliverables and milestones 3.2 Management structure and procedures 3.3 Consortium as a whole 3.4 Resources to be committed	Vision / Team Fit

Table 4: Mapping EC H2020 projects to the "Four Fits" model

In other words, consortia bidding for funding in a H2020 call, for example in the upcoming WP 2018-20, *already* need to pay attention to the respective Fit model for each section of the proposal. In fact, if a project consortium does not or only insufficiently pay attention to the three Fit models mapped in the table above, the proposed project is likely to fail during its execution, or even worse, all preparation effort may be wasted because funding reviewers may have rejected the proposal in the beginning.

The fourth Fit model, the Business Model / Market Fit, is folded into section 2.2. However, we conclude that both proposers and reviewers should not pay too much attention to speculations or "guesstimates" on potential business values of hypothetic products or services outputted from a project: Three or four years down the road (including proposal preparation, review and contract negotiation), a clear and worked out business model is the result of many iterations during project collaboration and aspire to have it already defined in the proposal is illusory, and should not consume too much of valuable and sparse effort at the proposal stage.

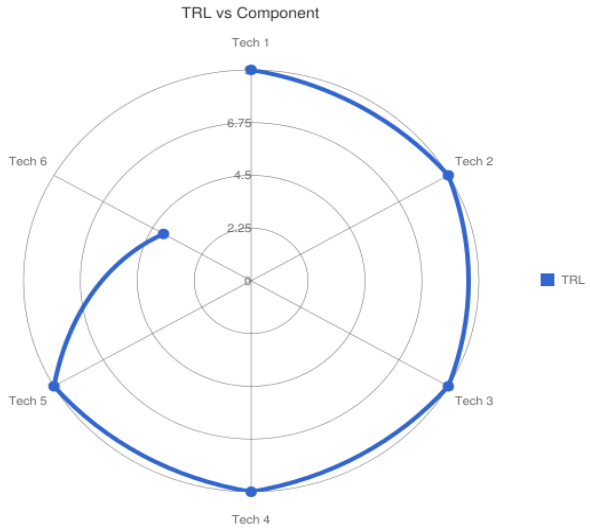
[14] http://ec.europa.eu/research/participants/data/ref/h2020/other/call_ptef/pt/h2020-call-pt-einfra-ria-22-2016_en.pdf

5.2 Methodology improvements

We are aware that the concept of MRL as developed externally, and the associated methodology are only at their beginning. Yet we have demonstrated their usefulness during our engagement with a number of EC-funded projects as part of our CloudWATCH2 activities (see above). This early feedback enabled us to identify some of the potential improvements needed to provide even more value to anyone who seeks feedback and assessment.

5.2.1 First-level decomposition for higher-resolution TRL and MRL

While an overall score on both TRL and MRL is useful, it inherently hides some of the details that contributed to this assessment and score assignment. Whereas two different projects might share the same TRL score, the composition of that score, and associated risks might be entirely different: A project undertaking research and/or innovation on a number of technical components of an aspired solution might have to rely on few mature components at TRL 9; as a consequence, this project would need to implement strong risk management fairly prominently in its structure. Another project, however, resembles an Enterprise Application Integration structure with the vast majority of components on TRL 9 and only one or



two components in need of technical maturing before market entry.

Figure 6: A typical first-level decomposition of an EAI project

Such first-level decomposition is well known in the technical domain, but is just as applicable to the market and business side of a project with a go-to-market strategy. Obviously, the level of detail and number of first-level components may vary from project to project, however the appropriate visualisation as radar or spider charts accurately conveys the message.

5.2.2 Correlating TRL and MRL - project maturity index

We conjecture that TRL and MRL correlate in specific ways. In its extremes, it is obvious that achieving TRL 9 should not be accompanied with an MRL score of 0, otherwise time could be wasted preparing for market entry. Conversely, an overly ambitious go-to-market strategy should not oversell on a product at TRL 0. Apart from these obvious extremes, we expect that among the mathematical permutations of any pairwise

combination of TRL and MRL certain common paths, or trajectories, exist that are popular and most commonly used, for reasons we can only speculate about at this time.

With the emergence of this methodology and gathering data points over time, we expect to be able to identify these trajectories and extract common profiles tracing archetypes of H2020 projects such as Research & Innovation Actions, Innovation Actions, Support Actions, or technology and market segments (KIT, Robotics, Software and Cloud, Marine biology, e-Infrastructures, etc.) across the entire H2020 portfolio, and beyond.

A similar approach is used and successfully implemented in the CMMI[15] program, initially developed at Carnegie Mellon University, but now administered by the CMMI institute, now a subsidiary of ISACA[16]. Much like CMMI's staged representation, a hypothetical H2020 project maturity model may emerge from future work, defining typical and common phases of H2020 projects as a benchmark for assessment in annual reviews.

6 Future work

This model is only at its beginning. Despite integrating many well-known concepts and methodologies established in the respective markets (e.g. CMMI, the "Fit" model, multi-channel marketing, etc.), the integration into an umbrella model is in its early stages, at TRL 4 and hence needs to be developed further.

A specific recommendation of the CloudWATCH2 project's Y1 review suggests contacting the EC's H2020 Exploitation Booster programme[13] equipped with ancillary funding, for projects to request help on specific exploitation issues (e.g. business modelling). This can be seen as either positive or negative depending on the viewpoint, in that the current model's problem/solution fit is already validated through the mere existence of the exploitation booster programme. It may however also be seen as a threat if considered as a potentially exploitable output in a commercial context, e.g. as a paid-for service offered to projects.

Likewise, the way the current model is delivered is similar to the role of the reviewers at compulsory annual reviews of funded projects, even with coincidentally similar results (c.f. MUSA project). Somewhere in between that spectrum might be an exploitable niche for the output to sustain.

On the MRL side of things, the Problem/Solution and Vision/Founder Fits are progressing well; further market testing to advance the MRL to 5 (and ancillary also TRL to 5), we plan to further invite more projects for a review by the three experts, with an improved model and methodology. As we grow more confident in the methodology and delivery of the service, we plan to work towards a public delivery of one model assessment with a volunteer project on stage, probably at NetFutures 2017, alongside further closed doors assessments. The third session of project assessments is indicatively earmarked for a final CloudWATCH2 event which is currently under discussion of project partners.

[15] http://cmmiinstitute.com/what-is-cmmi
[16] http://www.isaca.org/About-ISACA/Press-room/News-Releases/2016/Pages/ISACA-Acquires-Global-Capability-Maturity-Leader-CMMI-Institute.aspx

7 Log Table

DOCUMENT ITERATIONS		
v1	First project-internal draft	Frank Bennett, iCloud, Frank Khan Sullivan, SB, Michel Drescher, UOXF
v2	Author-organisation review	Michel Drescher, UOXF
v3	Internal consortium review	David Wallom, UOXF; Theodora Dragan, ICTL; Nicholas Ferguson, Trust-IT
vFinal		Michel Drescher, UOXF

8 Appendix: Request for Information form

The following table provides the RFI form in tabular form. The original Google Form can be accessed at https://docs.google.com/forms/d/1wUTYEGVg12e28ii2uKg4MQRvXtlBqSPjMI4bX39us4U.

Field No.	Title/Name	Requested information
GENERAL INFORMATION		
1	Full name	The name of the main contact person for the review, usually the project coordinator.
2	Email address	A contact email address.
3	Project name	The full name and acronym of the project for future reference
4	Website	The project's main website, i.e. the landing page.
5	Phone number	A phone number to contact the representative in case of need.
6	CloudForward2016 registration?	Used to cross-check and synchronise with the conference organisers on the participants list
MARKET READINESS		
7	Project pitch	Provide a project pitch in no more than 100 words.
8	Target users	Describe the intended target users and customers for the projects' outputs.
9	Current marketing activities	Which marketing and sales activities have already been implemented?
10	Completed a BMC?	Asking the projects whether they have completed a Business Model Canvas indicates which level of understanding they have on commercial operation of products and services.
11	Additional Information/Marketing activities	Answers expected here would typically cover the usual projects' dissemination activities as described in the project proposal.
Technology Readiness		
12	Project Outcomes	To provide a list of intended or already achieved technical project outcomes, expected as an enumeration of products or services, or identifiable components thereof.
13	Project Maturity	A self-assessment inform of TRL scoring, or according to CMMI. Answers here would indicate a project's understanding of technical maturation of both project outputs and technical personnel.

14	Link to demo	Live demonstration instances, or recorded videos can explain more than a thousand words.
15	Additional evidence	Any information a project would feel help their assessment, such as position papers, press releases, posters, etc.
16	Technical descriptions	Any ancillary information, such as white papers, software documentation, architecture diagrams, etc.