From Project To Product

A New & Improved Approach to Technology & Market Readiness

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Introduction

There is a need for Research & Innovation ("R&I") outputs to be useful, usable and used, and today, many such initiatives are for capabilities that will run in the cloud, use the cloud for test and development or scalability testing, or use cloud-centric platforms for services or microservices.

For many projects such as cloud-based purely digital or hybrid digital-physical workflows and processes, products and services, and/or customer-facing capabilities, these outputs may go unused despite greater emphasis being placed on increased 'impact' or 'sustainability objectives'.

This article overviews a new approach that has been trialed in the largest European Union research program ever. Developed with the support of the CloudWATCH2 project[1], this framework can increase the value of R&I project outputs as well as reducing individual project failure rates.

The current method for assessing technology maturity through *Technology Readiness Levels* (TRLs), fails to take into account who will use or pay for the technology. Just as technology must be readied for market entry, support systems and processes—which are increasingly digital and cloud-centric because they are IaaS-based or exploit SaaS functionality such as online knowledge bases, CRM, or billing—must be in place before a product can be successfully sold or a service offered, and customers must be ready, or enabled to be ready, to acquire and use the technology. The gap between technology and market readiness must be bridged with a better approach.

We model the maturity of these support services and processes as 'Market Readiness Levels' (MRLs). The concept behind both measures is the same - both communicating at a high abstraction level the current status, as well as a future desired goal.

[1] CloudWATCH2 has received funding from the European Union's Horizon 2020 programme - DG CONNECT Software & Services, Cloud. Contract No. 644748

It is important to keep the following design goals in mind;

- Readiness Levels (RLs) must be contextualized within the project domain
- RLs do not imply constraints on the size or complexity of the product/service
- RLs do not impose a level of maturity or perfection of the assessed domain
- RLs are independent of project management methods (e.g. Agile or Six Sigma)

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

Cloud-Centric Innovation

Cloud computing plays a pivotal part in enabling projects, startups and even large organizations to innovate. Having a platform to build software offerings and products at a lower cost of deployment, with the possibility of scaling rapidly, has been a driver in bringing new research outputs to market. New methodologies such as agile or lean (with a Minimum Viable Product) have adapted to cope with uncertainty, and emphasize the validation of learning and ideas. Our proposed method recognizes how vital it is for a project to consider *how* beyond just the pure technology the offered product or service reaches the market through a continuous deployment model. Finally, by combining development and operations ("DevOps") with continuous deployment of a software or technology proposition, the validation of the offering happens quicker.

Technology & Market Readiness

Successful exploitation of innovation in cloud computing can be challenging. At the research and development ("R&D") stage, classifying the current maturity of a technology or project output is a relatively easy task - Technology Readiness Level definitions exist and are widely employed. The method was developed by NASA[2] and, more than 20 years later, can be found in use by a number of organizations ranging from the UK Parliament[3] to the European Space Agency[4] and the European Commission Horizon 2020 (H2020) programme[5], the largest EU research and innovation program ever, with almost 80 million euros of funding available over 7 years. H2020 spans initiatives including Future Internet, Advanced Computing, and Content Technologies and Information Management.

Much effort goes into developing the technological aspects of products and project outputs. However, a corresponding amount of support activity is vital to bring those outputs to market. This support includes business strategy, business modeling, marketing, sales, after-sales

[2] http://www.hq.nasa.gov/office/codeq/trl/trl.pdf

[3] http://www.publications.parliament.uk/pa/cm201011/cmselect/cmsctech/619/61913.htm

[4] http://sci.esa.int/sci-ft/50124-technology-readiness-level/

[5] http://ec.europa.eu/research/participants/data/ref/h2020/other/wp/2016_2017/annexes/h2020-wp1617-annex-g-trl_en.pdf

support, service desks, IT service management systems, supply chain management, staff training and education, business change and transition, to name but a few.

The overarching problem is that the most common method of assessing technology readiness fails to take into account market readiness, even though the best technology in the world is of no commercial value if it lacks marketability. Market readiness is a classification of a technology's traction in the world beyond the lab. Ultimately, it can be used to benchmark success across an R&D portfolio - in improving the likelihood that a project's outputs will thrive in the real world and also to accelerate time-to-market for a catalogue of R&D outputs.

Consider a Project's Legacy

A collection of unread research papers or project deliverables is of no more value to society than a portfolio of obsolete patents. Whilst recognizing that different types of research will have different sets of goals - and the importance of pure 'blue sky' research - it is essential that funding for research and innovation/development projects is coupled to how successfully its outputs can be exploited, and that the activities have demonstrable impact.

With respect to the size of a potential constituency of users of a given technology or project output, be it a handful of industry experts or society-at-large, the impact of innovation can only be articulated once measured. And that measurement is simply a change in combined technology or market readiness levels. To fairly judge whether or not a project has been successful, its outputs must be defined in the context of *who* benefits in the long-term.

Three major factors affect the legacy of a project beyond its funding lifecycle:

- Readiness – Whether the technology or service is ready for production
- Awareness – Whether anyone knows of the new or improved technology
- Motivation - Whether stakeholders have the incentive to continue activities

Too often is timing cited as the cause of project stagnation. When planning to productize a project output, a projection of the product or service's maturity is necessary in order to calculate lead times and graduate successfully through the Readiness Levels.

Creating a Lasting Impact

Research and innovation projects are usually set up to find a solution for a need. By implication, if a project's outputs are to be productized, early-stage exploitation planning should be a vital part of a project's activities. Although action to commercialize or valorize (monetize and increase the return of) the technology is typically implemented later in the project lifecycle, the decision must be taken relatively early on. The decision to valorize a technology must be informed by a credible trajectory from a current state of readiness to a

future state, however the timing for such a decision must be informed by the project's velocity between scores.

At the macro level, this approach to measuring technology and market readiness can be used to improve the sustainability and exploitation of R&D projects, and elevate the success of any impact acceleration work therein. This approach delivers a more complete view of a project, both technically and non-technically. The evaluation of outputs in the context of market and technology readiness communicate a project's status effectively—both to the project team, and to decision makers who may find it difficult to diagnose problem areas early on or even have a complete view of the internal workings of any single project.

We are aiming for this approach to be used to decrease the risk of project failure by focusing R&D efforts on fulfilling the needs of a project's constituent users. Ultimately, our aim is to increase the value of a portfolio of innovative cloud technology projects over time. By benchmarking current states of market and technology readiness, and plotting a trajectory from the current score to an improved near-term score, progress becomes demonstrable. With frank and unambiguous recommendations on how to progress along that trajectory, the project is more likely to arrive at an improved readiness score. Through use of our proposed approach, a project can make the decision to productize their outputs or take a view to commercializing their outputs early on and focus their resources on a successful outcome.

How The Method Works

We consider it important to briefly reiterate both the concept and context of Technology Readiness Levels (TRLs). For the purpose of the proposed methodology our definition of Technology Readiness Levels are 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 (early prototype).	Prototype

TRL	Description	Phase
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: Our definition of Technology Readiness Levels.

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

Market Readiness Levels (MRLs) visualize the work performed behind the scenes in the development of business process and administration, just as TRLs do for the technical activities. A key element of MRLs is a sound business model preparing for understanding the key mechanics of the product or service - the very popular Business Model Canvas[6] is a useful tool as a way of capturing information and developing a common understanding of the activities, models, processes and stakeholders in the project. Secondly, we include the model of "Four Fits" into the process of enacting a go to market strategy:

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

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

Table 2: The four essential 'Fit' criteria for business success

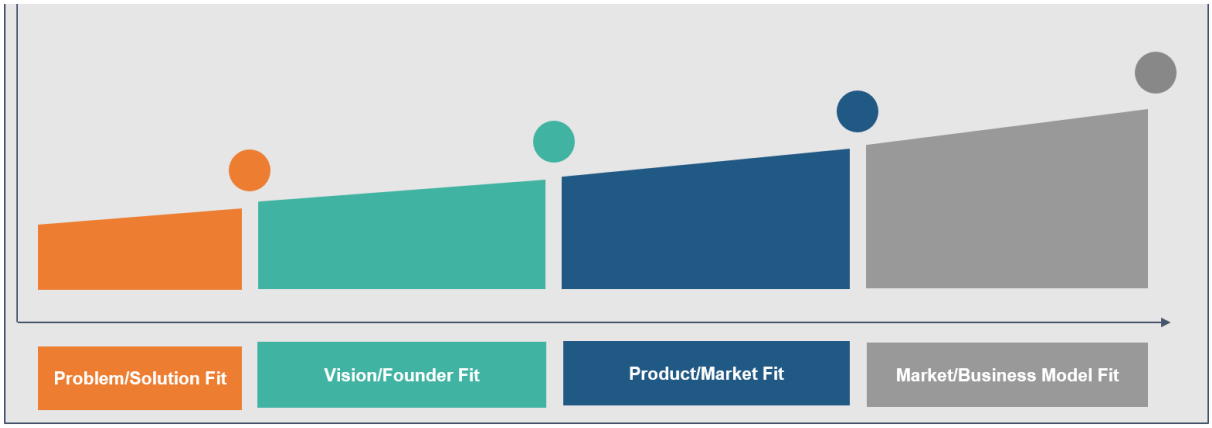

Figure 1: Succession of Business Fit criteria in product development

With these initial building blocks in place, we define the Market Readiness Levels as follows.

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

MRL	Description	Phase
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.	

The key innovative concept described in this article combines assessing international collaborative projects not only according to the definition of TRL, but always in combination with the new concept of Market Readiness Levels. This has been trialed with EC H2020 projects[7] as a direct response to the European Commission's increased focus on project output exploitation[8] and commercialization.

This approach includes a powerful visualization technique that can be used in distinct ways.

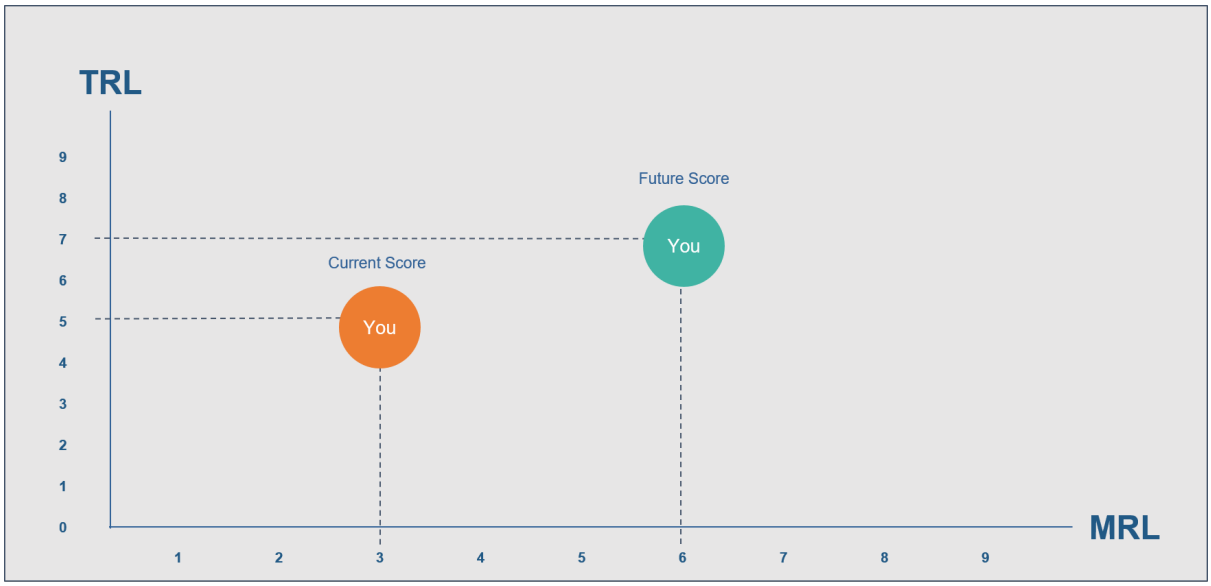

Figure 2: Key milestones on a project's trajectory towards improving MTRL scores. [9]

[7] http://cf2016.holacloud.eu/smes-event/workshop/

[8] http://ec.europa.eu/research/participants/data/ref/h2020/other/wp/2016-2017/annexes/h2020-wp1617-annex-ga_en.pdf

[9] Market & Technology Readiness Assessments (2016. Frank Bennett, Frank Khan Sullivan, Michel Drescher.)

It can be used as a project assessment method, allowing reviewers (or those that may be considering supporting post-project exploitation activities) to quantify the current state of a project under study. For example, an assessment may result in a "5:3" score indicating that the project is currently in possession of a large-scale prototype (TRL 5) that has yet to be validated through users in a small-scale campaign. External assessors can indicate the future potential of the project as they distill it from the information available to them at the time of the review (see Figure 4). In essence, this technique allows them to change from the unfortunately common "benchmarking the past" type of review and moving the focus from what has not been achieved (negative slant), to the positive, the opportunities of a project.

The second 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 visualization 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. Where the apparatus to transfer a technology to a constituency of users or paying customers does not exist, either within the project itself or as a dedicated externally available service from the funder, the expected outputs of R&D funding may never see the light of day. Conversely, with the necessary early-stage support mechanisms in place, innovation can be coupled to value creation.

Conclusion

In conclusion, the gap between technology and market readiness must be bridged through the use of a method that aims to directly support sustainable project outputs. By combining market and technology readiness levels, it is possible to articulate a project's current status, and plot a trajectory to a successful outcome. The method can be used as a strategy and communication tool for individual projects, or for a group of projects in benchmarking the success of a portfolio of R&D projects. Finally, this project support methodology can be rapidly deployed in many circumstances to increase the long-term value of R&D outputs, especially within the fields of cloud computing and advanced software.

Authors

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