Innovation and Safe System Road Infrastructure

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Abstract

Implementation of Safe System in Australia and New Zealand demands many changes in the way road infrastructure is designed and delivered. While there have been many innovative road safety treatments successfully trialled and evaluated, their introduction into mainstream road planning and design has been very slow. This paper draws on innovation management and agile product development techniques to propose a streamlined innovation pathway to fast-track development, trialling and adoption of new Safe System road infrastructure solutions.

Background

Road agencies already recognise that innovation is essential to meet the growing and changing demands of the community and governments. New trends and disruptive changes require development of new road infrastructure solutions, or adaptation of the existing. In this context, implementation of the Safe System vision sometimes calls for development of innovative road design and operational solutions which minimise death and serious injury.

Innovation in road infrastructure has not been progressing evenly in all areas. Based on recent publications, it is clear that C-ITS, pavement and asset management technologies have been evolving more quickly than other areas, e.g. road infrastructure design standards (Coscia 2016, Department of Transport and Main Roads 2016, Transport for New South Wales 2016). It has been recognised in recent literature, e.g. Pratt, McGarrigle & Turner (2015), that the time taken to identify, introduce, evaluate and adopt new road safety solutions into formal design guidance is exceptionally long, up to 20 years in some cases. Hence, there is a need to invigorate and guide design innovation when new challenges of Safe System cannot be accommodated by existing standards.

Innovation Pathway

Review of publications in the field innovation management led to the proposition, that principles applicable to new consumer product development could be successfully applied to developing new road infrastructure solutions (e.g. Simon, 1969, Kline 1985, Brown 2008, Ries 2011, Keely et al. 2013, Giacomin 2014).

These inputs were used to propose an innovation pathway for development of new Safe System road infrastructure solutions. Figure 1 shows the proposed Safe System road infrastructure pathway. The process begins with development of user insights and defining an innovation challenge (e.g. minimise severe crashes at urban intersections).

Setting of solution objectives critical to channel the available resource opportunities towards meeting the set challenge (e.g. minimise opposing-turning crashes, minimise all crash severities, do not degrade existing level of service). More specifically, KPIs are set to help experts and practitioners to guide their ideas towards new solutions based on research evidence, best practice and road user inputs. These KPIs are also used to select one or more optimal solutions for trial.

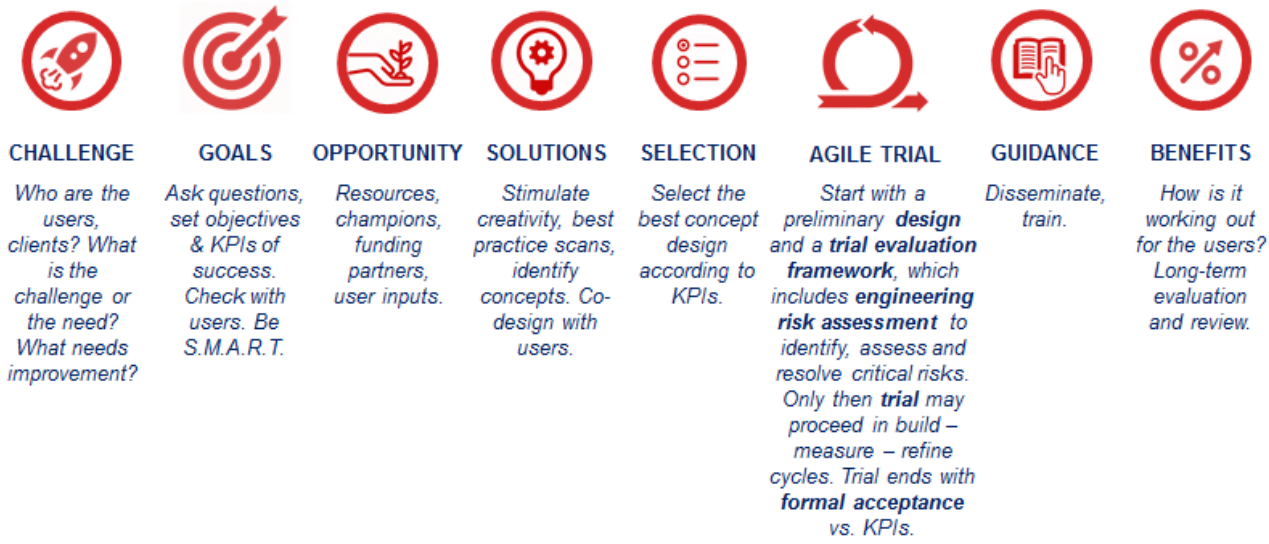

Figure 1. Proposed road infrastructure innovation pathway

Step six, the agile trial, is based on agile product development technique of iterative testing of design assumptions vs. user needs. It consists of preparing a trial evaluation framework for the selected design solution, a formal engineering risk assessment, the trial itself, and an acceptance process. This provides an opportunity to identify and address any major unintended user and operational risks before the adoption of the solution. Also, the agile trial process is designed to produce an estimate of solution effectiveness vs. the KPIs. The agile trial is based on fast build – measure – refine iterations, as shown in Figure 2. This approach guarantees that significant safety, operational and legal risks are identified, assessed and engineered out before acceptance into practice.

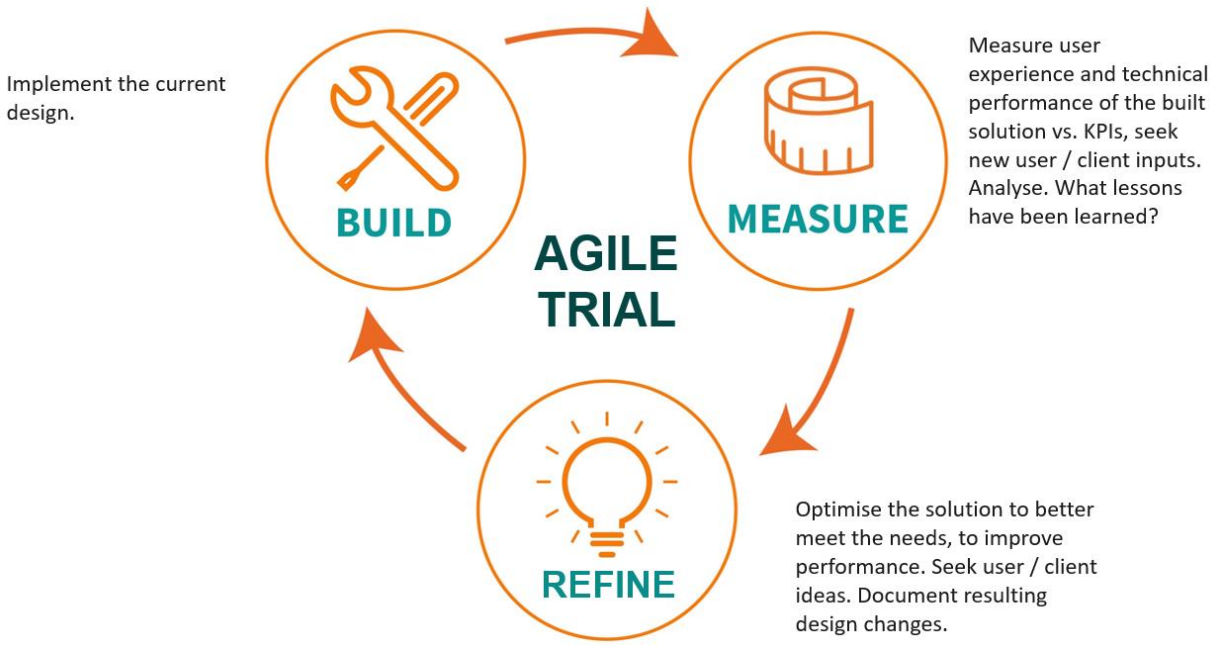

Figure 2. Agile trial process

This agile process allows the concept design solution to be refined in short time at a low cost (Smith 2007, Ries 2011, Moran 2014). Timeline sensitivity analysis suggests that full development of an

innovative small-scale infrastructure solution is likely to take less than two years from setting the challenge to inclusion in the guidance.

Formal acceptance into guidance and practice should be carried out by assessing the solution's trial performance vs. the KPIs by an expert group. Additional information may be sourced from the trial to formulate application boundaries (e.g. low-volume roads only), and to propose further development and evaluation steps, e.g. to extend solution to more road environments, or to evaluate long-term injury reduction effectiveness.

The pathway could be applied from any of the steps onwards, e.g. to an already identified solution about to commence trials. It is important, however, to pause and consider the previous steps to fully understand what user needs are being met by the solution, what should be the KPIs for success, and what risks may have to be engineered out.

Conclusions

The proposed innovation pathway offers a user-centred approach to fast-tracking development of new road infrastructure solutions to meet the demands of Safe System implementation. The pathway may be useful in other areas of road transport as well, e.g. in generation of road network management solutions, or in transport planning. Future trialling and refinement of the innovation pathway is encouraged by the road and transport agencies.

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