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The role of policy labs for introducing autonomous vehicles

Håkan Burden[1] (hakan.burden@ri.se)*, Cilli Sobiech[1], Kristina Andersson[1], Martin Skoglund[1] and Susanne Stenberg[1]

1. RISE Research Institutes of Sweden, Sweden

Abstract

This paper explains the methodological approach of policy labs as used in applied research projects on autonomous vehicles in Sweden. While introducing new technologies we need to ensure that regulations and policies keep up with the fast-paced technological development.

Policy labs is one way of managing the perceived conflict between technological innovation and existing regulations. Within a policy lab, a wide range of stakeholders gather to solve the bottlenecks for innovations together. We show through three different R&D projects how the policy lab approach can be applied and which results, improvements and challenges it revealed for introducing autonomous vehicles.

Keywords: Public authorities, reasonably safe operations

Introduction

Technical innovation plays a central role in how we talk about our society and its future. The challenges we are facing require new solutions that contribute towards a sustainable development. In that context existing laws and policies are often seen as slowing down or creating barriers for successful innovation [Schneier, 2019]. When technological innovation and business opportunities evolve faster than the laws and regulations it creates challenges for sustainable development as the democratically decided rules slip behind, creating social tensions between entrepreneurs, politicians and members of society.

To give a concrete example related to autonomous vehicles, the responsibilities of the driver in current regulations needs to be discussed, adapted or transferred in order to allow for broad market introduction of driver-less vehicles, otherwise the public trust and willingness to use the new services will have a negative impact on the business opportunities as well as create tensions between authorities and technology developers.

That leads us to the question of how policy can align to the rapid development within technology and business?

The challenge is not to create new laws in the same speed as technology is introduced on the market, but to ensure a reasonably safe introduction without hindering sustainable development. Our contribution describes how we facilitate policy development through a policy lab approach in tandem to three different R&D projects related to autonomous vehicles. We show in this contribution how this approach is applied in collaboration projects and conclude which results, improvements and lessons learned it revealed for the introduction of autonomous vehicles.

Policy and Policy Labs

Policy is a concept that can be exemplified by the quote "Code is law" [Lessig, 2009]. Lessig argues that contrary to public belief software-intense innovation is regulated, not by our democratically elected lawmakers, but by the decisions taken when implementing the code. These decisions can be informed by international standards and business opportunities, but also through laws and regulations. GDPR is an example of the latter while ISO 26262 is an example of the former. Policy as a concept therefore resonates with the idea of governance – the interactions and their rationale between private and public stakeholders that play a role as decisions are planned, executed and evaluated in a societal context [Stoker, 1998].

There is a number of ways to facilitate policy development, such as test beds [Engels], regulatory sandboxes [Zetsche] and labs. For the case of this contribution the focus is on policy labs as an enabler for safe market introduction of new technology.

An EU report from 2016 defines the activities of policy labs as to "approach policy issues through a creative, design, or user-oriented perspective […] strive to organize experiments to test proposed policies […] work for or within a government entity or public administration and contribute to the shaping or implementation public policies" [Fuller, 2016]. A policy lab can be an organization, a place (physical or virtual), methodology or a project that aims to shape or implement public policies, through co-design with relevant stakeholders [Hagy, 2017], in an agile fashion (iterative and incremental) [Mergel, 2016], drawing on multiple disciplines [Junginger, 2016].

Policy labs exist in several countries. The European Commission has an EU Policy Lab as well as the Government Offices in the United Kingdom have a UK Policy Lab. In 2016, the European Commission published a progress report on policy labs in Europe [Fuller, 2016]. The report lists 65 active policy labs that operate in different areas, e.g. education, finance, migration, the labor market, the environment and transport. From the USA, the UC Davis Policy Institute and Stanford Change Labs can be mentioned. There are also organizations that have policy lab-like structures such as the Organization for Economic Cooperation and Development (OECD) that has the Observatory of Public Sector Innovation (OPSI). The World Economic Forum also has lab environments.

Policy labs at RISE, Research Institutes of Sweden, are typically run as a collaboration project with stakeholders from both the public and private domain. The project work is focused around one or more concrete cases so that there are explicit details to explore and relate to the more abstract theories and regulations. In this context the policy lab is initiated as a time-boxed initiative with a set deadline. The activities include workshops to share ideas and to co-create solutions, interviews with stakeholders,

keeping an eye on international initiatives as well as staying up to date on regulatory discussions. The data is then analysed in relation to existing regulations, previous research and across stakeholders to get a broader understanding of what is possible, desirable and sustainable in terms of introducing new technology.

The stakeholder contributions to the policy lab vary according to stakes, aims and capabilities over time. Governmental authorities might participate at workshops to listen to other stakeholders or present their own responsibility and ambitions; private enterprises might submit their challenge to get new insights or demonstrate their expertise; and academia can contribute with a different perspective from other disciplines or markets. Who does what is often decided on a case-to-case basis, depending on the nature of the case and the interests of the participating stakeholders. As an example, in Drive Sweden Policy Lab there were three challenges, two of them raised by private companies and one by a governmental agency [Andersson, Burden and Stenberg, 2021]. In all three challenges there were representation in one way or the other by SMEs, national and local authorities as well as established private enterprises.

In the following, three different collaboration projects, coordinated by RISE and involving the policy lab approach, are explained related to the introduction of autonomous vehicles.

Co-creating Public Policy for Autonomous Vehicles

The aim of Policy Lab for Autonomous Transport Services (PLATT, due to the Swedish acronym) was to evolve public policy in relation to the new regulation for trialing autonomous vehicles on roads [Burden and Andersson, 2019]. When the new regulation was introduced in 2017 it was both welcomed and feared. Welcomed by many since it enabled actors to trial autonomous vehicles with the approval of the Swedish Transport Agency (STA), feared by some since it was unclear what was needed to get an approval, what it would cost and how long time the process would take. In response to the perceived challenges some of the early adopters asked the STA for a more agile way of governing, a request that was seen as contradictory to the Swedish Public Administration Act that states that an application has to be completed before it can be assessed.

Through two concrete trial applications and workshops involving applicants and other stakeholders, PLATT investigated the perceived challenges and how they could be mitigated within the Public Administration Act. The outcome was a report detailing practical advice on what to include in an application as well as the need for continuous communication with the STA. The STA also took the opportunity to present their updated information at a workshop before uploading it to their webpage. The information clarified the cost for the handling of an application and expected lead times but also detailed the different steps from initial contact to an approved application. The updated process also included a phase where it was possible to iterate certain aspects of the application.

Another outcome was that through the application process both the STA and one of the applicants agreed that the technology proposed for one of the trials was to be considered as level 2 according to the SAE definitions [SAE, 2018] and therefore out of scope for the new regulation.

Throughout the project both local and national authorities were involved in the activities, besides the STA, as well as multinational companies interested in the new business possibilities with autonomous transportation, operators of autonomous vehicles in Sweden, OEMs and a second research institute. In this way the project not only served to explore the challenge but also to facilitate rapid sharing of insights and experiences across the Swedish eco-system.
The project ran November 2018 to November 2019 and was financed through the Strategic Innovation Program Drive Sweden and Vinnova, the Swedish Innovation Agency.

Self-certification of Autonomous Vehicles

The success of PLATT encouraged Drive Sweden to fund a policy lab with a direct link to on-going technology-driven projects. The ambition was to couple technological innovation with policy while the technology was still under development. Drive Sweden Policy Lab (DSPL) was therefore created as an open project where stakeholders could pitch in their policy challenges. The project started in November 2019 and ran until December 2020. During that time three different policy challenges were addressed, of which one is directly targeting autonomous vehicles [Andersson, Burden, Stenberg, 2021].
The question under consideration was which regulations are applicable for a type-approved bus if it is manually driven on roads but has an autonomous driving system which is only active in the depot? Type-approved vehicles are governed by the vehicle regulations that Sweden have adopted from the UN Economic Commission for Europe [UNECE, 2005], which in turn rely on an exemption from the machine directive [MD, 2006]. In Sweden there is regulation for trialing autonomous vehicles, but it only applies for trials on roads. Since the depot is a confined area the regulation is not applicable. So, for the bus there are no exemptions from the machine directive since there are no types of autonomous vehicles that only operate within confined areas. The bus is therefore a machine within the depot and a vehicle on road.
From a European perspective this has implications. Vehicles are type-approved by a national authority before they are allowed entering the market. For Swedish OEMs this is done by the STA. But machines can be introduced without an authority having approved them in advance. The requisite for market introduction is that the machine is self-certified to be reasonably safe to operate in its designated environment. For machines this is done by the manufacturer through CE-marking.
In short, CE-marking requires that the manufacturer identifies the applicable rules, standards and product-specific requirements, such as for machines or electro-magnetic radiation levels. The manufacturer then verifies that the product meets the requirements, and lists the possible risks associated with operating the machine (don’t bathe with your hair dryer on). After that the manufacturer has the right to stamp the CE-mark on the product. CE-marked products can be introduced into the market without prior assessment by an authority. If the machine is involved in a serious accident the certification and machine can be reviewed by an authority, in the case of Sweden that would be The Swedish Work Environment Authority (SWEA). While the overall approach for

CE-marking is the same for all EU members, each member state appoints an administration for national governance.

The outcome of DSPL was an analysis of which regulations are applicable for a bus that no longer is a stable entity but rather a vehicle on road and machine within enclosed areas. Since the analysis was shared with representatives from both the STA who manage type-approvement and trialing of autonomous vehicles as well as the SWEA that govern machines, the analysis was independently reviewed and accepted by the two authorities. As a result, the Swedish authorities are prepared to act according to existing regulations to handle the future introduction of type-approved vehicles that can transform into autonomous machines.

There is also another implication, since the US market allows a manufacturer to use a certification process of their own choice when guaranteeing compliance with the federal requirements for road safety [NHTSA, 2020]. Thus, the analysis put forward is that over time self-certification will probably drive not only the emergence of new standards for both technologies and processes to enable large-scale production as well as certification, but it might also influence future European regulations regarding how to ensure the safety of autonomous vehicles. However, stating that autonomous vehicles can be self-certified and CE-marked is one thing, to perform the certification is something entirely different. But if the manufacturers in the US show that they can self-certify their autonomous vehicles and thereby accelerate their innovation process, it might tip the scales so that self-certification becomes the future for European vehicle manufacturers as well.

A Safety Case for Remote operations of Autonomous Trucks

The aim of the SCAT (Safety Case for Autonomous Trucks) project is to contribute to the next development phase by systematically investigating - legally as well as technically - how to safely operate remote assisted vehicles in mixed traffic *and* with higher velocity than in today's pilots in Sweden. Partners along the entire chain from technology suppliers to operators are involved, building upon Swedish-French expertise. The project, coordinated by RISE, runs from November 2020 until April 2022 and is partially financed through Drive Sweden and Vinnova.

By addressing critical safety and security aspects, both from a technical and legal perspective, the project prepares for and finally demonstrates goods transport without a safety host onboard in Gothenburg, Sweden. Yet, the main focus is on exploring the safety case and to provide evidence for theory building, practical improvement and recommendations of how to safely operate remote assisted vehicles in Sweden, France and other EU countries. Using test tracks and fenced areas allows us to explore the limiting parameters, thereby stress-testing the boundaries of the system under real conditions with higher velocity – before the actual trial will be run.

Remotely operated and autonomous vehicles with higher velocity in mixed traffic is putting new technical and policy challenges on the systems. The changes in operational design requires new ways of validation and verification, both in terms of procedure and actual tests, to understand what is reasonably safe ways of introducing new technology. The partners of the consortium built upon knowledge gained in earlier research projects, such as PLATT, and earlier pilot demonstrations to

together identify key challenges that need to be investigated more in-depth, finding synergies and key aspects for enabling niche market adoption.

Previous experiences showed that risk analyses for self-driving and remote operation requires a wider approach compared to traditional analyses. From a technical perspective, many aspects determine how safety is ensured. Ideally all top-level requirements should be validated as part of design validation. Yet, it is virtually impossible to validate an automated vehicle against all possible scenarios it will face in the real-world traffic. Thus, there is a need to have a balance between the representativeness of the tests and the reliable performance indicators. A subset of requirements needs to be identified for certification tests, giving evidence that all other requirements are met [HEADSTART, 2019]. The identification needs to be connected to specific use cases, ADS features and product designs. In general, it is expected that the requirements used in design validation are stricter than the requirements during certification testing for margins during the latter. An example can be seen in the considered UN Regulation on uniform provisions concerning the approval of vehicles with regards to Automated Lane Keeping System [UNECE, 2020].

From a policy perspective, legal questions need to be addressed such as how to take responsibility in emergency situations when a vehicle is remotely operated? Who takes care of current requirements to place a warning triangle and take other measures? What is the operator´s responsibilities and control possibilities for several vehicles? In which cases do you need an incident reporting for liability and how can this look like? Further, more long-term oriented strategies need to be investigated related to remote operations, such as how to include aspects such as insurance, criminal law, driving license and labor regulations in different EU countries.

Discussion of the policy lab approach

New regulations is one way to address challenges of new technology. There are other options, such as clearer processes or collaboration across governmental authorities. Policy Labs is one way of facilitating such activities. Policy lab is a neutral place for authorities and other stakeholders to meet so that experiences can be shared and new ideas discussed without forcing the issue. Each stakeholder still has the mandate over their own decisions and do not need to promise anything for the future. Instead, they can go back to their own organization and reflect on what they have learnt, plan new strategies and if appropriate share these in a following session. Since technology, business and regulations are under constant scrutiny and development, there is a need for continuous policy activities to facilitate the innovation process.

Sweden has a long tradition of triple-helix collaborations [Leydesdorff, 1998], paving the way for policy lab as a format for facilitating innovation. Combining the established format of collaboration with researching specific challenges also seems like a viable way to move forward as the concrete case provides details that anchor the theoretical findings and make them actionable. In this way the policy lab way of working resonates with the ideas behind regulatory sandboxes [Zetzsche, 2017] and test beds [Engels, 2019]. While the way there differs the insights and experiences allow for new ways of moving forward in collaboration.

It is also important to remember that some authorities have a reviewing capacity and that they need to ensure that their participation in policy labs does not jeopardise the impartiality of future decisions or creates a bias towards certain stakeholders. Their involvement requires a longitudinal approach as well as the establishment of trust, something that has to be carried out differently for each authority. There is no silver bullet here that magically works for all.

A possible drawback of policy labs is their representativity, both in terms of what is discussed and who participates in the discussion. If you cannot see the relevance of the case for your own business or you for some reason cannot participate, your view might not be taken into account. While there are ways to mitigate such risks in terms of interviewing fringe stakeholders or cross-referencing to other markets and cases to find new aspects, there is always a risk that the outcome is too closely tied to the case and the participants. Therefore, the outcome of the policy labs is not to be confused with legal inquiries but taken as a first analysis and step forward. The next step could be a more substantial inquiry or yet another policy lab to involve more stakeholders or explore new cases.

Another risk of policy labs being case-driven as projects is that the longitudinal perspective is lost. It is therefore important for the stakeholders to establish longevity by actively creating a chain of projects to carry insights between policy labs. Otherwise, there is a risk that each lab is an island by itself, rather based on a personal basis of individual researchers, than on a stable organization for other labs to connect to.

According to the European report on policy labs, there are policy labs on various organisational levels, from city level to national level, but there is very little collaboration between different policy labs in the member states and internationally [Fuller, 2016]. In parts this depends on the already complex work in a policy lab, where collaboration with others would increase the complexity further. Still, documentation of skills, processes and knowledge sharing of results achieved in different policy labs would be a useful outcome of more collaboration.

Conclusion

In general, the policy lab approach contributed to the introduction of autonomous vehicles with competence supply in terms of knowledge, skills and improved judgement. Such as the knowledge of which rules apply for new types of technology, skills how you can analyse the business opportunities of autonomous vehicles in relation to existing regulations and if these business opportunities are sustainable in the long run? In this way policy labs facilitates solving policy challenges together with stakeholders from both the public and private domain. The project work is focused around one or more concrete cases so that there are explicit details to explore and relate to the more abstract theories and regulations. From the three cases we conclude that policy labs facilitated:

- how to apply and understand the new regulation enabling actors to trial autonomous vehicles with the approval of the Swedish Transport Agency, specifically in clarifying the steps of the application process as well as the content of an application and the cost for having it assessed by the agency;

- how to handle technology that moves between different regulations depending on where it is used and when it is in an autonomous mode, an analysis that has an impact on business opportunities and which competences are needed within the companies, as well as preparing the authorities in how to handle sector-crossing technology when it is ready for market introduction; and
- how to combine the technical and the policy perspective in exploring the safety case for remote operations and higher velocities, both in a Swedish context but also for the French project parties by exploring the common ground between national regulations on a harmonised European market.

For the future we expect to further explore the safety cases for autonomous technology in terms of new standards and regulations as well as how to self-certify an autonomous vehicle in a European context.

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