CONNECTSMART 2.0 PROJECT:
SCENARIO PLANNING FOR TECHNOLOGY-BASED MOBILITY OPPORTUNITIES IN NOVA SCOTIA

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1. Introduction

The ConnectSmart 2 Project is funded by the Connect2 grant administered by the Nova Scotia Department of Energy and Mines. This project took place between March 2018 to March 2019 and built on the ConnectSmart Project conducted in 2017-2018. The project aimed to create discussion among Nova Scotians around the inevitable wave of new mobility, specifically connected, autonomous, shared and electric (CASE) vehicles. Through this project, the Dalhousie Transportation Collaboratory (DalTRAC) engaged professionals (planners, urban designers, engineers, energy specialists, etc.) and community stakeholders (active transportation and transit groups, non-for-profits, etc.) in collaborative discussions to assist in envisioning the future of mobility. We have facilitated this conversation through a published paper studying the impacts of a shared autonomous vehicle model on the Halifax Peninsula, academic conferences such as the annual meetings of the U.S. Transportation Review Board, a local scenario planning workshop, the creation of a Community Leadership Committee, and a social media campaign. DalTRAC plans to utilize what we have learned through the ConnectSmart 2 Project and the newly created network of community leaders to continue to research and lead discussions around how to prepare for emerging CASE technology.

This report describes the activities we have undertaken to complete the ConnectSmart 2 project. It begins by discussing the simulation study conducted by Alam and Habib (2018), followed by the scenario planning workshop held on February 22nd, 2019. It concludes with lessons learned and guiding principles. Workshop materials and results can be found in the Appendices.

2. Traffic Simulation Study

DalTRAC conducted a traffic simulation study (Alam and Habib, 2018) to explore the potential impacts of shared autonomous vehicles (SAVs) on the Halifax Peninsula. The automation of vehicles is considered to be the next big upcoming shift in the transportation industry and will "bring significant challenges [to] transportation planning" (p.497). The study developed a comprehensive modelling framework which was used to examine how SAVs could operate during peak morning commute hours (6:00 am to 9:00 am) and to understand the impacts of shared vehicle fleet size on traffic flow on the Halifax Peninsula.

A Halifax regional transport network model was used to simulate origin-destination traffic demand in the network and identify SAVs occupied and empty trips as well as trip requests attributed by trip IDs, departure times, etc. The microsimulation model tracked each individual from the start time of their trip to the end time at a destination. It simulated a total of 57,694 trips taken between typical morning commute hours, 6:00 am to 9:00 am. The model consisted of 91 urban core traffic analysis zones (TAZs), 91 sub-urban core TAZs and 37 rural TAZs. It also contained almost all arterial roads and a few collector roads within the study area. The SAVs were assumed to serve trips that had both origin and destination on the Peninsula, to use the same dispatch locations as CarShareHFX. Four levels of fleet sizes were tested, starting at 450 SAVs and doubling in size until the last level, with a 3600-SAV fleet.

The study investigated three potential scenarios, the first with only human-driven vehicle (HV) trips, the second with 85% HV trips and 15% SAV trips, and the third with 80% HV trips and 20% SAV trips. The two scenarios with SAV operation found that during the first hour (6:00 am to 7:00 am), SAVs achieved a higher level of efficiency than HVs, as SAVs simultaneously improved traffic and decreased overall travel time. However, as a result of empty SAV trips, there was an increase in total vehicle kilometres travelled (VKT) on the Peninsula in the simulations.

The study recommends that planners take special consideration to SAV operation planning and implement strategies to reduce empty trips in the network and to help prepare for SAVs. Future research is suggested for off-Peninsula trips and into vehicle characteristics for SAVs and HVs.

This paper was presented at the 9th International Conference on Ambient Systems, Networks and Technologies (ANT 2018) and published in the academic journal *Procedia Computer Science*. This paper received two evaluations. On reviewer stated that the results provided insight into the usefulness of SAV fleets of different size in the Halifax region. In particular, the evaluation stated that the results pointing towards increased VKT was interesting as it described a "fear" many analysts have about SAVs. However, the reviewer also suggested a discussion on the validity of the results, as it may take many years before SAVs are implemented and accepted at a large scale. The evaluation concluded that further research into SAVs is needed.

3. Scenario Planning Workshop

DalTRAC held a three-hour scenario planning workshop on new mobility on Friday, February 22nd. This workshop took place in the Emera IDEA Building in rooms 1003 (Meeting Room) and 1004 (Romero Classroom). This section discusses the research and planning process for these workshops and the workshop results.

3.1. Literature review

3.1.1. Search

The first task of organizing the workshop was to conduct a literature review of scenario planning and scenario planning matrices. To do this, Dalhousie Libraries, Novanet and Google Scholar were used. Words and phrases that were inputted into these search engines included, but were not limited to:

- Scenario planning
- Scenario planning matrix
- Scenario planning two-axis
- Scenario planning workshop
- Futures scenarios
- Futures workshop
- Transportation scenario planning
- Future of mobility scenario planning

Of the articles produced by this search, Table 3-1 shows the 11 primary articles that were used in the literature review.

Table 3-1. Literature review.

	Author(s)	Year	Title
1.	Butler, J.R.A. et al.	2016	Scenario planning to leap-frog the Sustainable Development Goals: An adaptation pathways approach
2.	Cao, M., Chen, C., & Hickman, R.	2017	Transport emissions in Beijing: A scenario planning approach
3.	Cobb, A.N. & Thompson, J.L.	2012	Climate change scenario planning: A model for the integration of science and management in environmental decision-making
4.	Knapp, C.N., Fresco, N., & Krutikov. L.	2017	Managing Alaska's National Parks in an era of uncertainty: An evaluation of scenario planning workshops
5.	Lauttamäki, V.	2016	ACTVOD-futures workshop – a generic structure for a one-day futures workshop

6.	Nygrén, N.A.	2018	Scenario workshops as a tool for participatory planning in a case of lake management
7.	Steenberg, J., Duinker, P., Creed, I., Serran, J., & Dallaire, C.	2018	Alternative scenarios for the future of Canadian boreal zone
8.	van 't Klooster, S. & van Asselt, M.	2006	Practising the scenario-axes technique
9.	Wulf, T., Brands, C., & Meissner, P.	2010	A scenario-based approach to strategic planning: Tool description – scenario matrix
10.	Zegras, C., Sussman, J., & Conklin, C.	2004	Scenario planning for strategic regional transportation planning
11.	Zmud, J., Ecola, L., Phelps, P., & Feige, I.	2013	The Future of Mobility: Scenarios for the United States in 2030

3.1.2. Goals

The goals of the literature review were to answer the following questions:

1. What is scenario planning and how do you use it?
2. Which scenario planning method/tool would best suit the workshop?
3. How do you conduct a scenario planning workshop using the scenario planning matrix?
4. And, are there other studies on scenario planning for new mobility?

3.1.3. Results

The scenario planning approach became notable in the late 1960s/early 1970s by Royal Dutch Shell (Zegras, Sussman, and Coklin, 2004). Shell had concentrated solely on physical planning and was challenged with "coordinating the scheduling of new facilities" (p.3). This caused planning issues with Shell's financing and as a result, they developed a long-term planning process. However, this process was largely dependent on forecasting, meaning that if the forecast was wrong, the process could not provide the right answers. Shell team members recognized this problem and developed an alternative planning approach that dealt with uncertainty and future visions that drove strategic action. Zegras, Sussman, and Coklin explain that thanks to Shell's application of scenario planning, they were better prepared for the oil crisis of 1973 and its economic effects.

The tool Shell used for scenario planning was the scenario axes, which is described as a "useful and straightforward tool to construct images of the future in a coherent and systematic way" (van 't Klooster and & van Asselt, 2006, p.17). A scenario matrix has a similar appearance to a coordinate plane, with an x- and a y-axis that overlap in the centre (Figure 3-1). During the scenario planning process, the axes of this matrix are filled in with the two most important driving forces that are both uncertain and impactful in the region. Authors van 't Klooster and van Asselt refer to these two forces as the "backbone" of the scenarios while the four scenario narratives are its "flesh" (p.17).

Literature states that scenario planning is a collaborative approach to promote the discussion of the risks and uncertainties related to a change (Steenberg et al., 2018; Cobb and Thompson, 2012; Butler et al., 2016; Nygrén, 2019). Steenberg et al. (2018) explain that "scenarios are not meant to be predictions; instead they are plausible and contrasting narratives informed by transdisciplinary and multi-stakeholder workshops" (p. 2). There are many ways to conduct a scenario planning workshop; Lauttamäki (2015) demonstrates that there is not one single defined way of hosting a futures workshop and instead, states that there are many factors that influence their organization, such as resources available, time constraints, personnel and workshop goals.

Today, transportation planning faces new challenges and large uncertainties (Zegras, Sussman, and Coklin, 2004). From Akin to Shell in the 1960s, transportation planning has been driven from a facility siting and supply focus to a "system- and demand-management perspective" and their underlying forces (Zegras, Sussman, and Coklin, 2004). While the scenario planning approach is not uncommon in transportation planning, there is limited research on potential future scenarios of new mobility and CASE, especially research that uses the scenario planning matrix. Literature surrounding scenario planning most often discusses environmental resource management or economic-based scenarios (Nygrén, 2019; Knapp, Fresco, and Krutikov, 2017; Cobb and Thompson, 2012; Steenberg et al., 2018). This is consistent with transportation planning as most scenario literature focuses on emissions or oil prices (e.g. Cao, Chen, and Hickman, 2017).

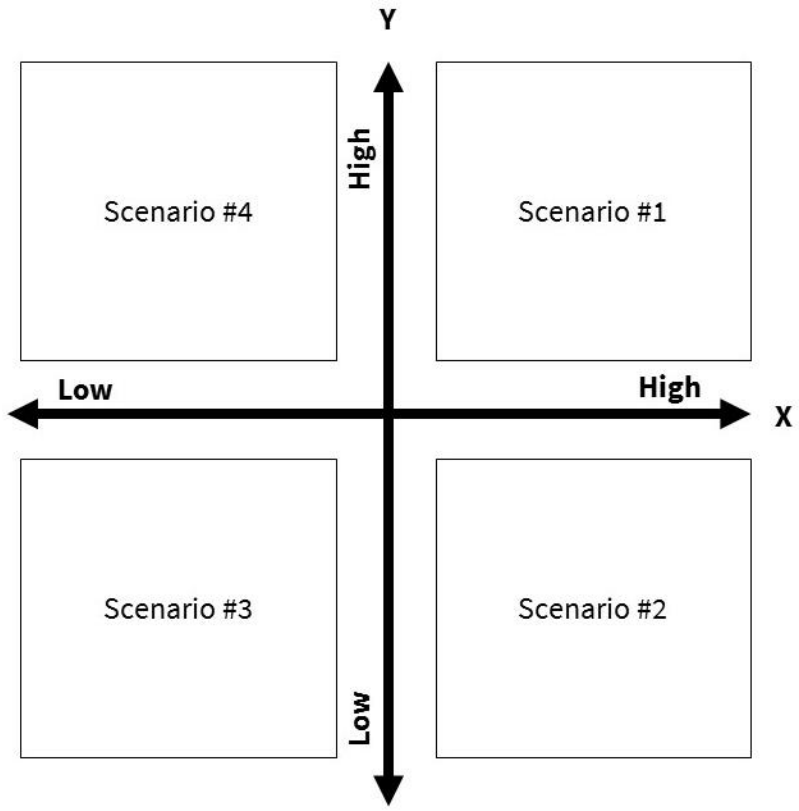


Figure 3-1. Scenario matrix.

3.2. Workshop

The workshop began at 2:00pm and lasted until 5:00pm. It was divided into four parts: one presentation and three sessions with a 15-minute break in the middle. Participants were asked to sign a sign-in sheet that also gave consent to having their photos taken. In total, there were 25 attendees, 16 of whom were external and 9 of whom were internal (student volunteers, the Principal Investigator (PI) and DalTRAC team members).

3.2.1. Presentation

The workshop started with a presentation from the PI (Figure 3-2 and Figure 3-3). As most workshop participants were not in attendance at the previous ConnectSmart workshop from 2018, the presentation started with a recap of connected, autonomous, shared and electric vehicles (CASE). This recap reviewed what CASE is and where the research currently stands. Mobility as a service was included in the discussion of shared mobility and the city of Helsinki, Finland was used as an example. Finally, the recap ended with a quick discussion of the lessons learned from the previous ConnectSmart workshop. The presentation can be found in Appendix A.

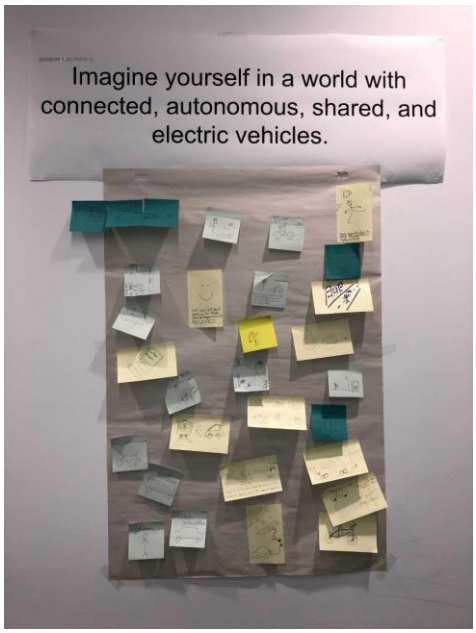
Following this, the ConnectSmart 2.0 Partnership was introduced. Participants learned DalTRAC's goals of 1) assessing how Canadian communities are planning for CASE mobility, 2) exploring mobility market dynamics, including households' mobility tool ownership, attitudes and preferences, anticipated adoption, willingness-to-pay and impacts; and 3) engaging in community-led scenario planning for identifying planning considerations, policy needs and risk management strategies for transportation and land use planning.

Scenario planning was then presented to the participants. The PI brought forth how uncertainties and driving forces shape scenario planning. A study of scenario planning for the future of mobility in the United States in 2030 was used as an example. This study, however, did not use the scenario planning matrix and only came up with two scenarios, "No Free Lunch" and "Fueled and Freewheeling" (Zmud, Ecola, Phelps, and Feige, 2013). This concluded the presentation portion of the workshop and commenced the first of three sessions.

Figure 3-2 and Figure 3-3. Workshop presentation facilitated by the PI.

3.2.2. Session one

The goal of session one was to determine the driving forces and the major uncertainties surrounding CASE. Session one was divided into three activities. Activity one asked participants to individually imagine a world with connected autonomous, shared and electric vehicles and to share these thoughts on the provided Post-it notes (Figure 3-4 and Figure 3-5). Participants thoughts varied as some people drew situations that were both optimistic (e.g. a healthier world, less worried about parking, increased use of shared vehicles, mobility subscriptions, and active transportation opportunities) and pessimistic (e.g. scared to be hit by an autonomous vehicle).



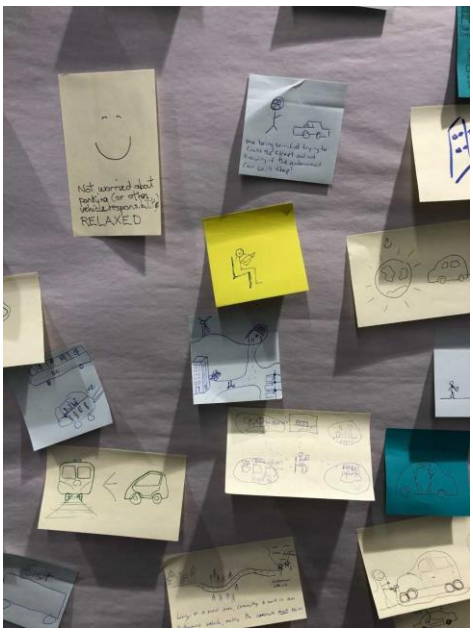
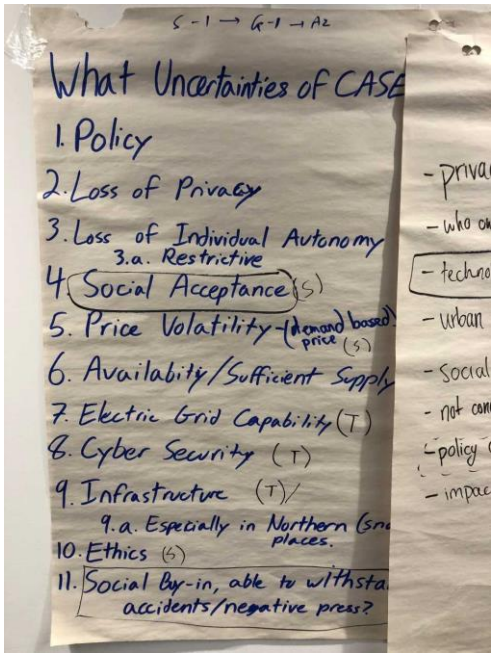


Figure 3-4 and Figure 3-5. Session 1, Activity 1 results.

Activity two split the participants into four groups of about five to seven people. It asked people to discuss and write down what are some uncertainties we can anticipate with CASE. Participants wrote down their groups' thoughts on provided flip chart sheets (Figure 3-6). Answers ranged from uncertainties about policy, social acceptance, infrastructure, grid capability, congestion, technological uncertainty, privacy concerns, etc. (Figure 3-8 and Figure 3-9). The groups' flip chart sheets were taped on the wall for other groups to examine (Figure 3-7).

Figure 3-6 (left) and Figure 3-7 (right). Participants discussing activity two and their answers being taped to the wall.



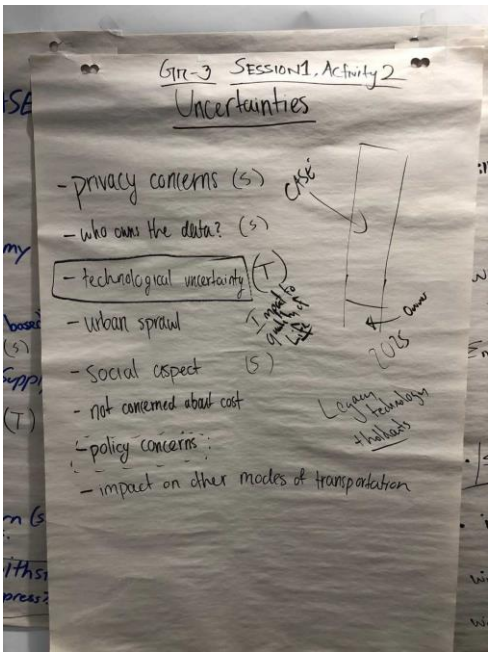
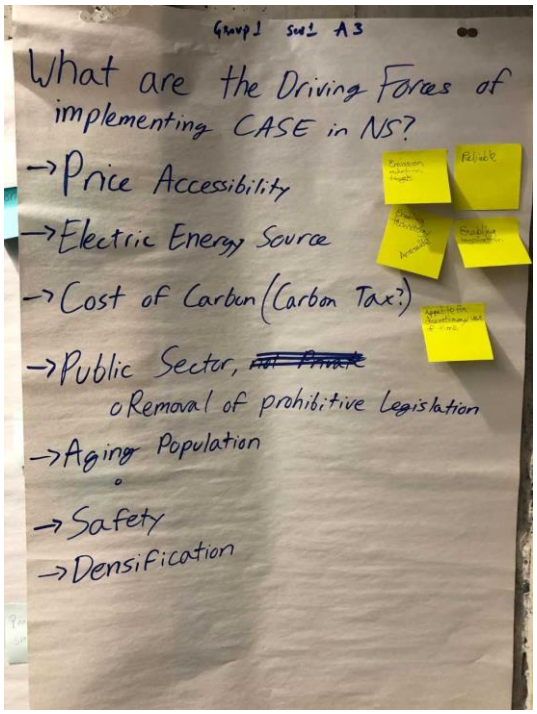


Figure 3-8 and Figure 3-9. Session 1, Activity 2 results from groups 1 and 3.

The final activity of Session one was to sketch the future of CASE in Nova Scotia. This was another group activity where participants discussed the driving forces of CASE mobility and organized their thoughts based on similar themes on the flip chart sheets (Figure 3-10). Again, these were stuck to the wall for other groups to see (Figure 3-12 and Figure 3-13). During this activity, the PI looked for patterns in the groups' answers from Activity 2 (Figure 3-11). He noticed that most uncertainties were either a social or a technological consideration. Following the completion of Activity 3, the PI compared this pattern to the driving forces. Once again, he found that the social and technological considerations stood out. He discussed with the participants who all agreed that for Session 2, the two most critical

driving forces would be 'Technological Advancement' and 'Societal Capacity to Adapt'. The workshop attendees then all had a 15-minute break where snacks and refreshments were provided by DalTRAC.

Figure 3-10 (left) and Figure 3-11 (right). Participants working on activity three and the PI finding common themes from activity two.



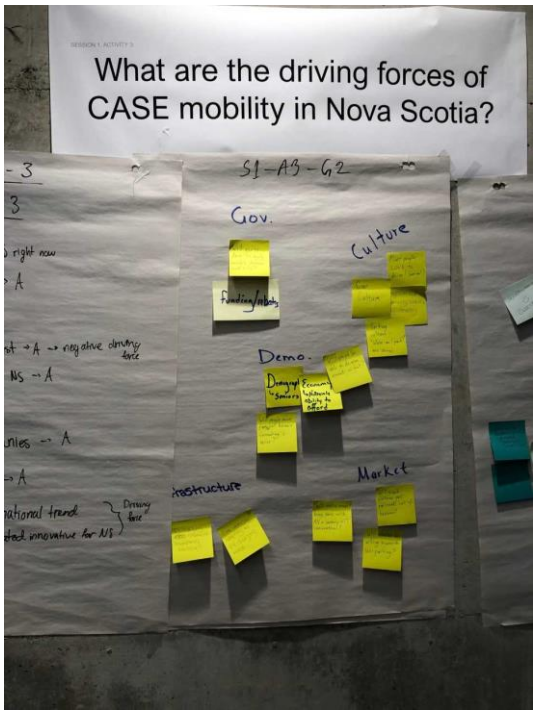


Figure 3-12 and Figure 3-13. Session 1, Activity 3 results from groups 1 and 3.

3.2.3. Session two

The primary goals of session two were to envision four possible scenarios for the future of CASE mobility in Nova Scotia and to discuss possible implications and strategies surrounding these. Session two was also split into three activities. Activity one introduced the participants to the scenario planning

matrix. The primary aspects of uncertainties identified in the first session were used as the two axes in the scenario matrix, forming four quadrants with different potential futures for CASE mobility in the province (Figure 3-14). Participants were asked to split up into four groups based on the scenario of their interest. Each group was given a large print out of one of the four quadrants and were asked to identify key attributes of their scenario if it were to occur in Nova Scotia (Appendix B). After about 20 minutes the participants were asked to report back on their findings. The groups came up with the following four scenarios:

1. The scenario created in the first quadrant (high societal capacity to adapt and high technological advancement) was the most optimistic of the four scenarios. The participants came up with a scenario where car ownership and fatal accidents from vehicles were non-existent and parking lots were uncommon which resulted in an efficient use of land for real estate and subsequentially lowered the cost of living. However, they also said that this could result in ruralisation and were uncertain about the fate of public transit.
2. The second quadrant (high societal capacity to adapt and low technological advancement) discussed a scenario where people are proactive in creating policies, developing infrastructure, raising awareness and starting small (e.g. with bikes) to be prepared for when technology advances.
3. The scenario in the third quadrant (low societal capacity to adapt and low technological advancement) was the most pessimistic. This scenario saw small changes to the current situation, such as an increase in suburban development and traffic congestion and a decrease in services in rural areas. On the other hand, the scenario did call for the continued shift towards active transportation, transit and mixed land uses.
4. The fourth quadrant (low societal capacity to adapt and high technological advancement) also had a negative point of view. In this scenario people refuse to adapt and thus, those who can afford to own their own vehicle still do and those who own electric vehicles own larger vehicles and liver further away from the city, because they are less concerned about environmental impacts. There is a high loss of jobs (similar to how grocery stores lost jobs after the implementation of self-checkouts) and not just in the taxi and driver industry but also the maintenance and courier industries. There is a lack of investment in active transportation and transit infrastructure. However, there is also world-leading technological research being produced from Dalhousie.

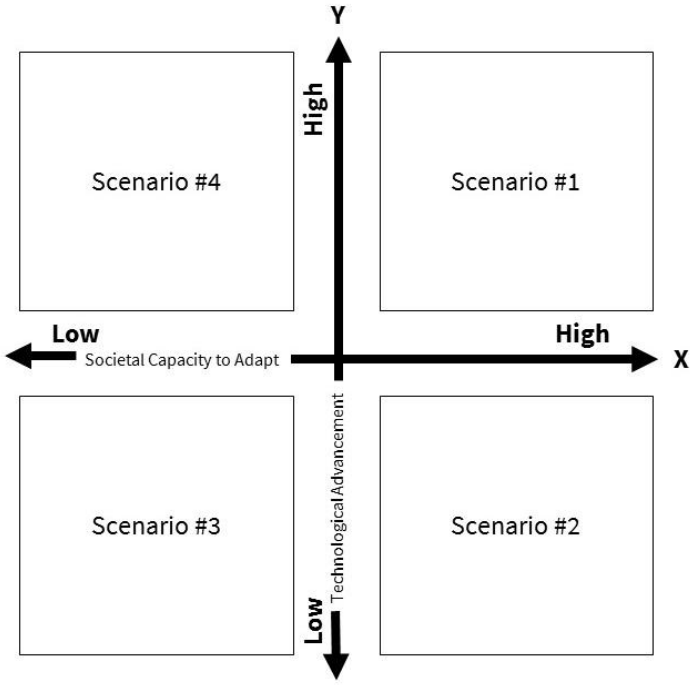
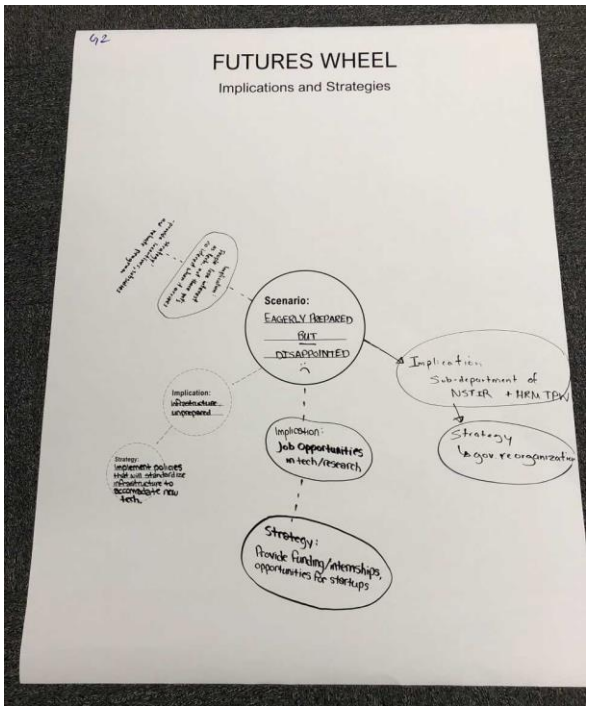


Figure 3-14. Scenario matrix with two critical uncertainties.



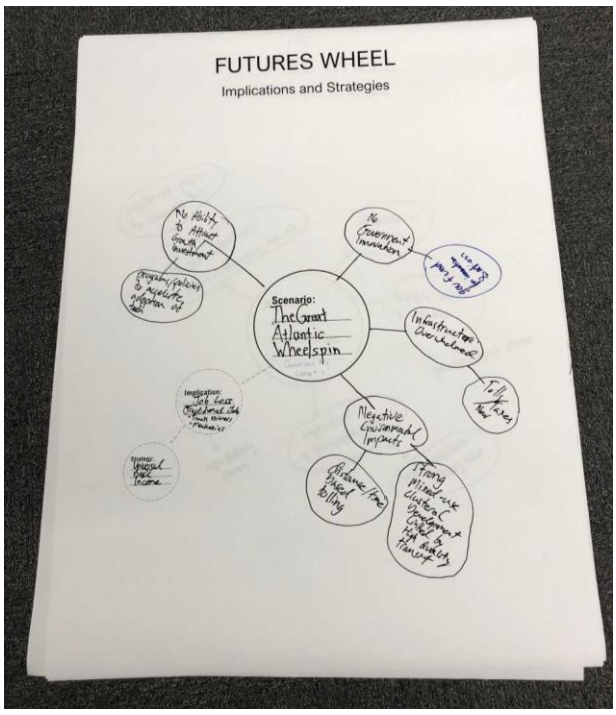


Figure 3-15 and Figure 3-16. Session 2, Activity 2 results from groups 2 and 4.

Activity two asked participants to create names for their scenarios. Participants came up with the following: Blue Sky Mobility (quadrant one), Eagerly Prepared BUT Disappointed (quadrant two), Evolution of the Status Quo (quadrant three), and The Great Atlantic Wheelspin (quadrant four). The groups then built a futures wheel off of their scenario that identified implications of that scenario and possible follow-up strategies (Figure 3-15 and Figure 3-16). Once again, each group was asked to present back their findings (Table 3-2).

Table 3-2. Session 2, Activity 2 results.

	Implications	Strategies
1. Blue Sky Mobility *(high societal capacity to adapt, high technological advancement)*	Lost driving jobs	- Reduce OT work hours - UBI - Retaining
	Need for charging stations	- Charging hubs - Vehicle to vehicle - Distributed generation (solar)
	Real estate opens up	
2. Eagerly Prepared BUT Disappointed *(high societal capacity to adapt, low technological advancement)*	Infrastructure unprepared	- Implement policies that will standardize infrastructure to accommodate new technology
	Job opportunities in tech/research	- Provide funding/internships, opportunities for start-ups
	Sub-department of NSTIR and HRM TPW	- Government reorganization
	People lose interest as technology is not there yet, no interest when it arrives	- Provide incentives, subsidies and rebate programs
3. Evolution of the Status Quo *(low societal capacity to adapt, low technological advancement)*	Congestion	- Higher density planning - Mixed modes of transportation
	No technological innovation Decrease services to rural areas Less car ownership/more cabs (rideshares) in network	- Using solutions we already have - Governmental choice - Implement policies to encourage this
	Decrease in GHGs	
4. The Great Atlantic Wheelspin *(low societal capacity to adapt, high technological advancement)*	No government innovation	- Government fund for innovation & action
	Infrastructure overwhelmed	- Tolls/taxes now
	Negative environmental impacts	- Distance/time-based tolling - Strong mixed-use cluster development limited by high quality transit
	Job loss (truck drivers, mechanics, etc.)	- Universal basic income
	No ability to attract growth/investment	- Programs/policies to accelerate adoption of technology

3.2.4. Session three

The final wrap-up session of the workshop only consisted of two activities: the circle of support and the workshop evaluation. The circle of support is a tool used previously by DalTRAC for the purpose of connecting to the community. It allows participants to state how interested they are in staying in touch and being part of the project (in this case, being a part of the CLC). The circle of support used in the workshop had four sections: the centre, aptly named "becoming a champion", was the location for participants who wanted to take the strongest leadership role in the committee; the middle circle, "actively participate in the CLC", was the section for those who were interested in taking part of the CLC but not lead the entire committee; the outer circle, "keep me informed", was the section for those who wanted to stay in touch but not always participate; the fourth and final section, "cheering from the sidelines", was for participants who are not interested in taking part (Figure 3-17). By this point in the workshop, some participants had left but the circle of support manage to collect eight names. Zero names were placed outside the circle, four names were place in the outer circle, three in the middle circle and one in the centre. A couple of names were placed across two circles, from which we assumed that the individual would sometimes be able to commit to the higher support level and sometimes the lower. Finally, the participants completed a five-minute workshop evaluation to conclude the event. The workshop evaluation is analysed in the following section.

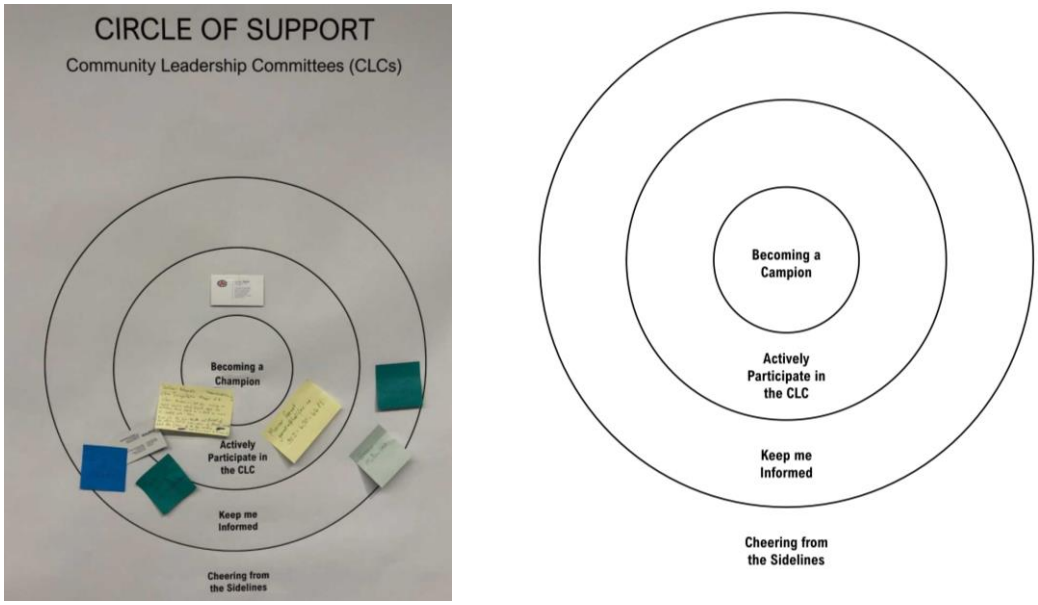


Figure 3-17. Session 3, Activity 1

3.3. Workshop evaluation

At the end of the workshop, participants were given a single-page workshop evaluation that asked a total of 10 questions (Appendix D). The survey response rate (not including the DalTRAC team members who were assisting with the workshop) was 87%, which was an improvement to the response rate from

previous year's workshop (70%). The evaluation was used to objectively measure the success of the workshop and to gain insights on improvements for future workshops. The evaluation was designed in a similar manner to the one that was distributed at the end of last year's ConnectSmart workshop for comparison reasons. The survey contained two multiple choice questions, five five-point Likert scale questions, two open-ended questions, and some lines for respondents to provide additional thoughts and comments.

3.3.1. Question 1. Were you familiar with smartphone app-based on-demand mobility services prior to the workshop? (e.g. Uber, Lyft)

This was a question that also appeared on the 2018 workshop evaluation survey. It was included in this survey because many of the participants who were involved with last year's workshop were different then those who attended the 2019 workshop. The purpose of this question is to gauge how aware participants are with smartphone app-based mobility services. Participants were provided with three options:

a. Yes, I have heard of them and used them elsewhere.
b. Yes, I have heard of them but have not used them.
c. No, I have never heard of them.

79% of participants have heard of and used smartphone app-based services, 21% have heard of them but not yet used them, and 0% of participants have never heard of them (Figure 3-18). In comparison to last year, participants were much more likely to have heard of and have used these services which can lead one to believe that they are becoming more popular.

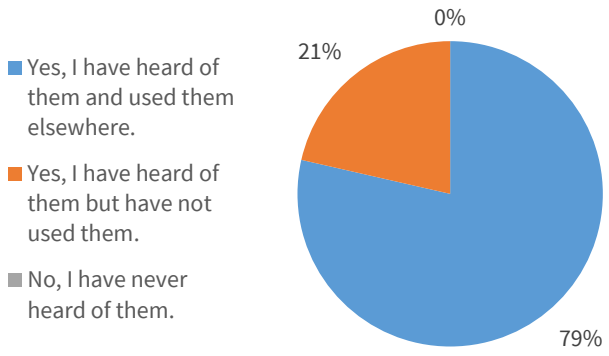


Figure 3-18. Participants' responses to Question 1.

3.3.2. Question 2. Were you familiar with scenario planning prior to this workshop?

The purpose of Question 2 was to gauge respondents' familiarity with scenario planning. Like Question 1, respondents were given three choices:

a. Yes, I have heard of scenario planning and used it before.
b. Yes, I have heard of scenario planning but have never used it.
c. No, I have never heard of scenario planning before.

Respondents were a lot less familiar with scenario planning than app-based mobility services. 29% answered that they have never heard of scenario planning, 57% said that they have heard of it but have never used it, and only 14% responded saying that they have used and heard of it before (Figure 3-19).

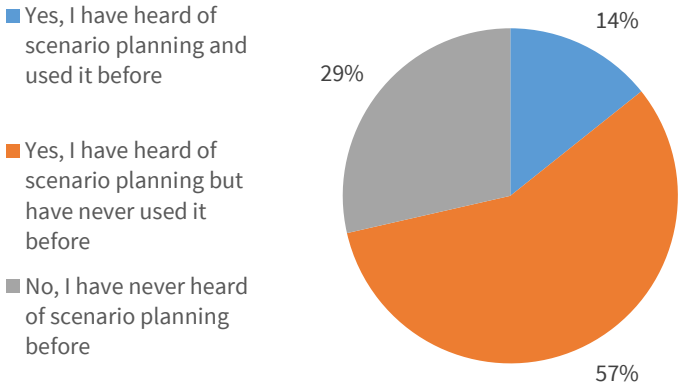


Figure 3-19. Participants' responses to Question 2.

3.3.3. Question 3. The workshop content was relevant, comprehensive and easy to understand.

Question 3 was the first of five five-point Likert scale questions, one meaning to strongly disagree and five meaning to strongly agree. Seven of the participants responded that they agreed, three people said that they were neutral, another three answered that they strongly agreed, and one person responded that they disagreed (Figure 3-20).

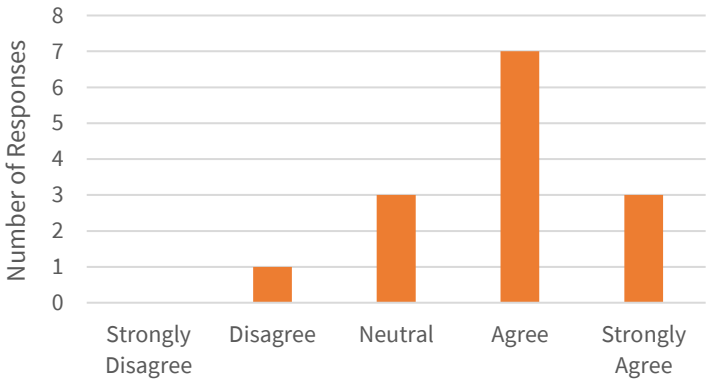


Figure 3-20. Participants' responses to Question 3.

3.3.4. Question 4. The activities were useful learning experiences.

Nine participants agreed that the workshop activates were useful learning experiences, three strongly agreed that the activities were useful, one participant said that they were felt neutral about the activities, and one more participant said that they disagreed (Figure 3-21).

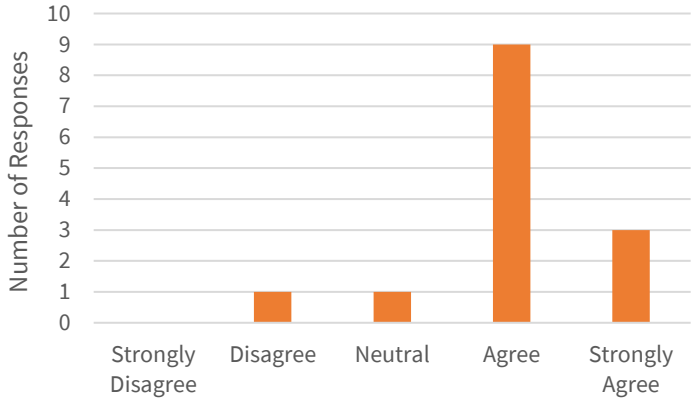


Figure 3-21. Participants' responses to Question 4.

3.3.5. Question 5. I will take what I learned at this workshop back to my organization and share it with my peers/coworkers.

Six respondents said that they strongly agreed that they would share what they learned at the workshop with their peers/coworkers, another six said that they agreed with this statement, and 2 respondents said that they felt neutral about the statement (Figure 3-22).

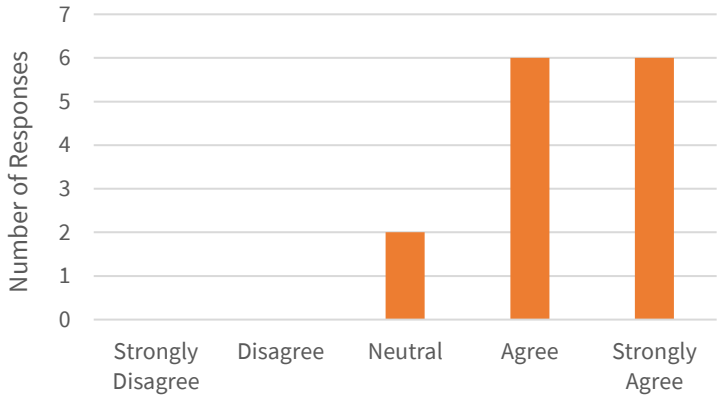


Figure 3-22. Participants' responses to Question 5.

3.3.6. Question 6. The workshop lived up to my expectations.

Eight of the respondents answered that they agreed that the workshop lived up to their expectations, three respondents said that they strongly agreed with this, two said that they were neutral about the statement, and one person said that they disagreed (Figure 3-23).

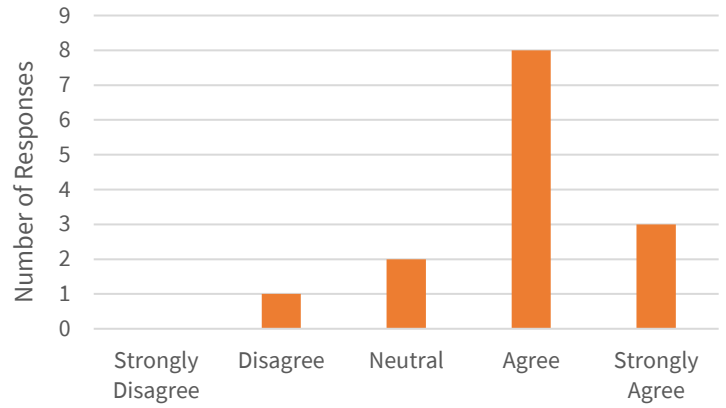


Figure 3-23. Participants' responses to Question 6.

3.3.7. Question 7. I am excited to be a part of the CLCs.

The final Likert scale question included a sixth option for participants to respond with as some participants may not have wanted to be included in the CLC. Those who didn't, could respond with N/A. Five respondents said that they agreed to the statement, three said they were neutral about being a part of the CLC, another three said that they strongly agreed that were excited, two said that this was not applicable to them (N/A), and one said that they disagreed (Figure 3-24).

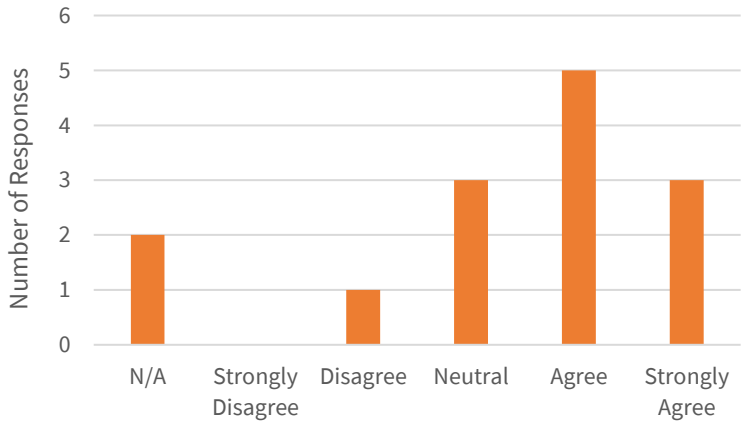


Figure 3-24. Participants' responses to Question 7.

3.3.8. Question 8. What did you like best about this workshop?

Question 8 was the first of two open-ended questions. Survey respondents' answers were categorized based on common themes, into the following three categories:

1. No response
2. Sessions/activities
3. Venue

Most participants (72%) stated that they liked the sessions the most, saying that the activities made them think and that they encouraged discussion and collaboration across multiple sectors; 21% did not provide a response; and 7% said that they liked the venue (Figure 3-25).

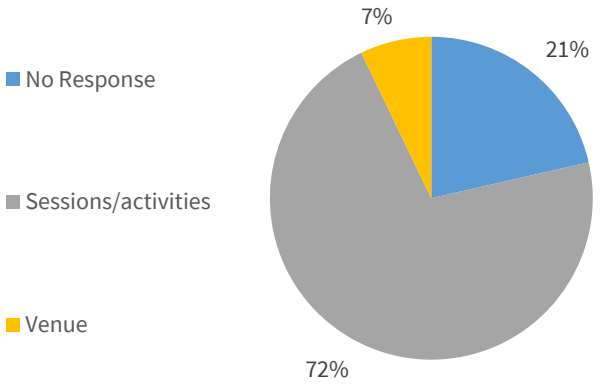


Figure 3-25. Participants' responses to Question 8.

3.3.9. Question 9. What did you like least about this workshop?

Question 9 was the second open-ended question. In addition to some no responses, five other themes emerged from answered provided in Question 9:

1. Duration
2. Instructions/definitions
3. Participation/engagement
4. Photography/filming
5. Other

Half of participants did not respond to this question; 22% said that they least liked the instructions/definitions, saying that they were slightly confused by some of the concepts, especially at the beginning; 7% said that they least liked the duration; 7% said that they least liked the participation/engagement, as they felt that some participants didn't seem as engaged; another 7% responded by saying they least liked the photography/filming of the workshop; and 7% of answers were categorized as 'other' (Figure 3-26). One response was categorized as 'other' because it did not

fit into a specific theme. The respondent felt that they could have been better prepared for the workshop, but they realized that this wasn't necessarily the fault of the workshop.

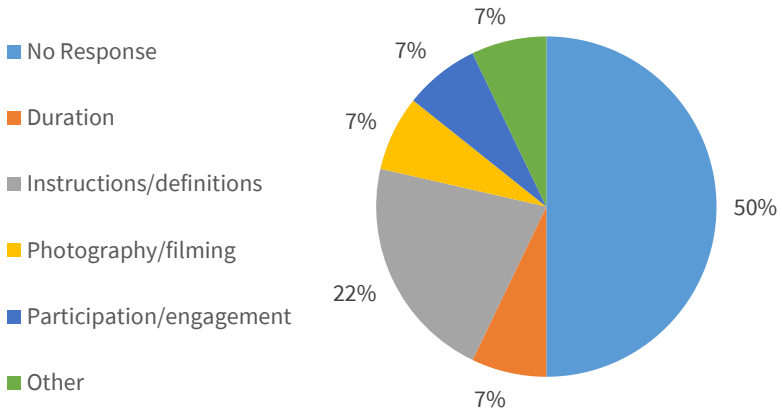


Figure 3-26. Participants' responses to Question 9.

3.3.10. Question 10. Additional comments?

Most respondents did not provide additional comments, however those that did mostly had compliments to give, saying that they enjoyed the snacks and the venue as well as the use of scenario planning as the primary tool in the workshop. One positive piece of feedback was that a respondent stated that they left with a clear idea of next steps and future outcomes. One recommendation provided was to have more time to work on scenario planning.

4. Conclusion

The ConnectSmart 2 project was an overall success. It united, educated and promoted the discussion of new mobility with both public and professional community members in Nova Scotia. The study on shared autonomous vehicles was published and taken to conference, influencing discussion beyond the Nova Scotia community. The scenario planning workshop, meanwhile, had much more of a local impact as it facilitated thinking, discussion and networking with Nova Scotian community members. Our social media campaign continues to promote conversation regarding new mobility technology worldwide. DalTRAC plans on continuing this dialog through updating the ConnectSmart website with proceedings from this project. It is through these initiatives that DalTRAC has helped to familiarize practitioners to newer technologies and concepts (e.g. CASE or MaaS), to illustrate the importance of planning for new mobility and to provide examples of participatory planning practices.

4.1. Lessons learned

The take away concepts from this project are that a shared autonomous vehicle (SAV) fleet operation in Halifax would improve the first hour of the peak morning commute period however, it would also increase the total vehicle kilometers travelled (VKT). From the scenario planning workshop, we learned that the critical uncertainties of CASE are technological advancement and societal capacity to adapt. The driving forces of CASE mobility were found to be infrastructure investment/availability, market, governmental focus/policy implementation, culture, and accessibility. Four future scenarios for CASE mobility in Nova Scotia were determined to be; (i) Blue Sky Mobility, (ii) Eagerly Prepared BUT disappointed, (iii) Evolution of the Status Quo, and (iv) The Great Atlantic Wheelspin.

One of the most notable achievements of this project was partnership development. This project enabled partnerships through a SHRCC grant application, which led to collaboration between five universities: Hasselt University (Belgium), the University of Toronto, l'Université de Technologie de Belfort-Montbéliard (France), and the University of British Columbia. The ConnectSmart 2.0 Project also created new local partnerships, such as with CAA Atlantic, through the creation of the Community Leadership Committee (CLC). This committee has allowed us to link together community members to form a transdisciplinary team which will collaborate on future projects and workshops.

Social media was found to be a useful tool for sharing knowledge and resources. We learned that certain social media platforms receive a better response depending on the content shared. We also learned that it can be used to engage people worldwide and improve awareness.

4.2. Future directions

The future direction of this work is to pursue researching this field and to continue the conversation of new mobility. DalTRAC would like to conduct a survey to learn more about the potential adoption of CASE in Nova Scotia. Particularly, we would like to conduct the NovaTRAC Survey 2019 with explicit

stated preference questions regarding CASE adoption in Nova Scotia. Additionally, we hope to expand our Community Leadership Committee (CLC) through further partnership building. To do this, we would like to conduct formal interviews with key stakeholders and host another workshop that engages both partners and the public to gather more information, develop guiding principles and to start planning for CASE mobility in Nova Scotia. We continue to seek further funding opportunities, including the SHHRC partnership grant that we have applied to, which, if approved, will help propel this project forward.

Acknowledgement of Contributors

MD Jahedul Alam (Ph.D. candidate, civil engineering) and Dr. Muhammad Ahsanul Habib (Principal Investigator) developed a traffic simulation model for shared autonomous vehicles and their impacts on the Halifax Peninsula. This study, *Investigation of the Impacts of Shared Autonomous Vehicle Operation in Halifax, Canada Using a Dynamic Traffic Microsimulation Mode* was published and taken to conference.

DalTRAC team members Katie Walker (DalTRAC Project Coordinator), Pauline Bela (M.A.Sc graduate student, civil engineering), Nazmul Arefin Khan (Ph.D. candidate, civil engineering), MD Jahedul Alam (Ph.D. candidate, civil engineering), Dinesh Guru (M.Eng graduate student, civil engineering), Utkarsh Ashokkumar Patel (M.Eng graduate student, civil engineering), John Jardine (MPLAN graduate student) and Stephen McCarthy (DalTRAC Research Associate and editor of this report) all assisted in hosting the scenario planning workshop. Workshop participants came from private and non-private organizations, including Halifax Regional Municipality, the Province of Nova Scotia, CAA Atlantic, Nova Scotia Power, Nova Scotia Health Authority, Sol Source, Dalhousie University, MacEachen Institute, the Ecology Action Centre, the Clean Foundation, the Halifax Cycling Coalition, and Heritage Gas. We would also like to thank the Canada Foundation for Innovation (CFI) for their continuous support of our research.

References

Alam, MD. J. & Habib, M. A. (2018). Investigation of the impacts of shared autonomous vehicle operation in Halifax, Canada using a dynamic traffic microsimulation model. *Procedia Computer Science, 130,* 496-503. doi: 10.1016/j.procs.2018.04.066

Butler, J.R.A. et al. (2016). Scenario planning to leap-frog the Sustainable Development Goals: An adaptation pathways approach. *Climate Risk Management, 12,* 83-99. https://doi.org/10.1016/j.crm.2015.11.003

Cao, M., Chen, C., & Hickman, R. (2017). Transport emissions in Beijing: A scenario planning approach. *Transport, 170*(2), 65-75. doi: 10.1680/jtran.15.00093

Cobb, A.N. & Thompson, J.L. (2012). Climate change scenario planning: A model for the integration of science and management in environmental decision-making. *Environmental Modelling & Software, 38,* 296-305. https://doi.org/10.1016/j.envsoft.2012.06.012

Corwin, S., Jameson, N., Pankratz, D.M., & Willigmann, P. (2016) The future of mobility: What's next? Retrieved from https://www2.deloitte.com/insights/us/en/focus/future-of-mobility/roadmap-for-future-of-urban-mobility.html

Hietanen, S. & Sahala, S. (2014). Mobility as a service: Can it be even better than owning a car? [PowerPoint]

Knapp, C.N., Fresco, N., & Krutikov. L. (2017). Managing Alaska's National Parks in an era of uncertainty: An evaluation of scenario planning workshops. *Regional Environmental Change, 17*(5), 1541-1552. doi: 10.1007/s10113-017-1126-4

Lauttamäki, V. (2016). ACTVOD-futures workshop – a generic structure for a one-day futures workshop. *Foresight, 18*(2), 156-171. doi: 10.1108/FS-01-2015-0003

Nygrén, N.A. (2018). Scenario workshops as a tool for participatory planning in a case of lake management, *Futures, 107*, 29-44. https://doi.org/10.1016/j.futures.2018.10.004

Steenberg, J., Duinker, P., Creed, I., Serran, J., & Dallaire, C. (2018). Alternative scenarios for the future of Canadian boreal zone. *Environmental Reviews, 0*(0), 2-58. DOI: 10.1139/er-2018-0062

van 't Klooster, S. & van Asselt, M. (2006). Practising the scenario-axes technique. *Futures, 38*(1), 15-30. doi: 10.1016/j.futures.2005.04.019

Wulf, T., Brands, C., & Meissner, P. (2010). *A scenario-based approach to strategic planning: Tool description–scenario matrix* (Working Paper No. 98). HHL, Leipzig.

Zegras, C., Sussman, J., & Conklin, C. (2004). Scenario planning for strategic regional transportation planning. *Journal of Urban Planning and Development*, 140(1), 2-13. doi: 10.1061/(ASCE)0733-9488(2004)130:1(2)

Zmud, J., Ecola, L., Phelps, P., & Feige, I. (2013). The future of mobility: Scenarios for the United States in 2030. Retrieved from RAND Corporation Website: https://www.rand.org/pubs/research_reports/RR246.html

Appendix A: Workshop Presentation

WORKSHOP OVERVIEW

CASE Recap
ConnectSmart 2.0 Partnership
Community Leadership Committees
Scenario Planning
- Session #1 (1 hour)

Break (15 minutes)
- Session #2 (1 hour)

Workshop Evaluation

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Photo Credit: Adobe Stock

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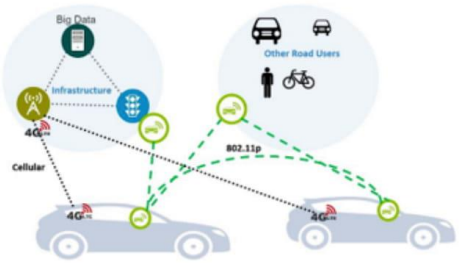
Autonomous Vehicles Levels

Level 0	Level 1	Level 2	Level 3	Level 4	Level 5
No Automation	**Driver Assistance**	**Hands Off**	**Eyes Off**	**Mind Off**	**Steering Wheel Option**
• System issues warnings only	• Assisted parking • Adaptive cruise control	• System takes over steering & acceleration	• Automated highway driving • System recognizes limits	• Automated city driving • Driverless Parking	• Full automation • Driver not needed

Autonomous Vehicles Levels

Methods of Connecting

Study by Virginia Tech (Doerzaph, 2017)



1) Dedicated Short Range Communications:

•Low latency
•High reliability
•High security and privacy
•Trusted connection
•Relatively short range
•Transportation agency ownership

2) 3G/4G Cellular:

•Nearly ubiquitous coverage
•Less reliable communications
•Higher latency
•Telecom owned

3) 5G Cellular (Future):

•Still in draft technical specs but promising
•Works from much of the existing cellular infrastructure
•Performance TBD
•V2V capability TBD
•Telecom owned

Planning Implications of Autonomous Vehicles

Study by Virginia Tech (Doerzaph, 2017)

1) Infrastructure 5-10 year Lifespan

- Comms equipment, connectivity, data management & storage
- Updates to legacy equipment, such as signal controllers may be necessary

2) Mobility Implications

- Models often show benefits, but still many assumptions under such estimates
- Mixed fleet is considered a key challenge for automated systems
- Huge potential gains once operational environment is refined (approx. 2x capacity increases)

3) Increased needs for monitoring & contingency planning

- System outage or failures become more significant
- System security becomes critical
- Privacy becomes critical

4) Capacity Building

- More capacity required
- Initial needs for broader knowledge and ability to bridge technical gaps
- Competitive hiring environment

5) Lots of Data

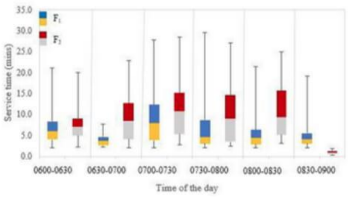
- Robustness of data you publish and applications it supports, what to do with the data?
- Means, desire & authority to monetize?
- Privacy concerns, public acceptance

Halifax Peninsula AV Impact Study

Study by Alam & Habib, 2018

Halifax Peninsula AV Impact Study

Study by Alam & Habib, 2018



	Hourly network performance evaluation			% Changes in VKT for peak periods	
Scenarios	Hours	% change in avg. speed	% change in total travel time	% change in total network VKT	% change in total Peninsula VKT
85% HV and 15% SAV trips	1st hour	9.64	-4.7	+1.73	+4.8
	2nd hour	-12.1	15.4		
	3rd hour	-25.3	33.4		
80% HV and 20% SAV trips	1st hour	7.5	-3.0	+3.63	+14
	2nd hour	-2.4	8.5		
	3rd hour	-15.2	18.7		

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SHARED MOBILITY

- Quickly being adopted in major cities North American wide
- Canadian cities such as Toronto and Ottawa currently have shared mobility regulatory framework in place
- One study shows that shared vehicles could overtake personally owned vehicles in urban areas by 2030

Bike Sharing


Car Sharing

Ride Sharing

Taxi Apps

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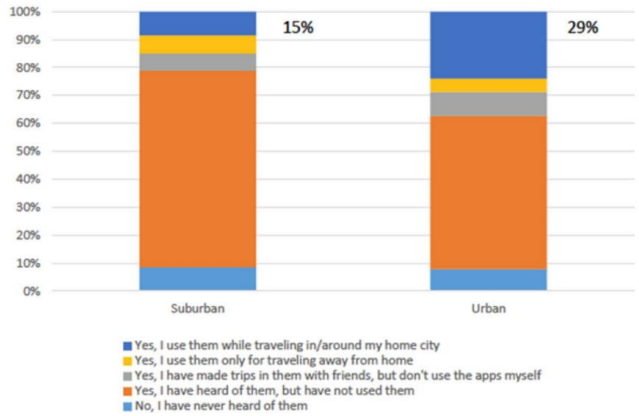
Adoption of Shared-Mobility Services

Study by UCDAVIS (Clewlow, Mishra, Jenn, Laberteaux, 2017)



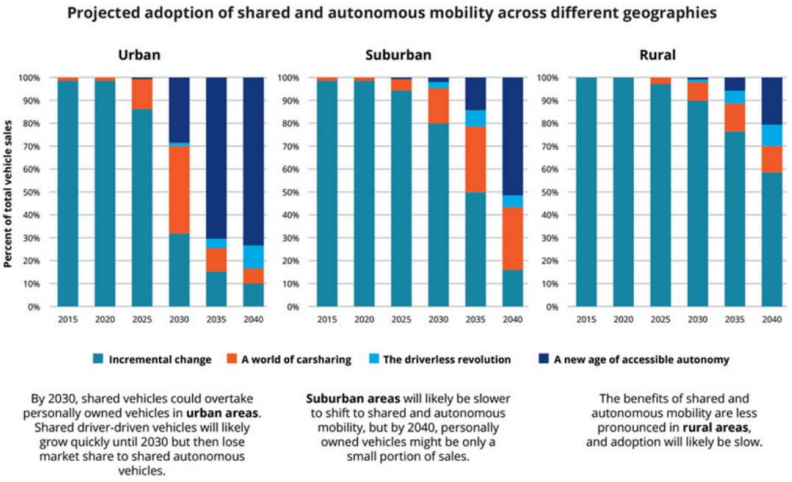
Locations:

- Boston, MA
- Chicago, IL
- Los Angeles, CA
- New York, CA
- Seattle, WA
- San Francisco, CA
- Washington, D.C.

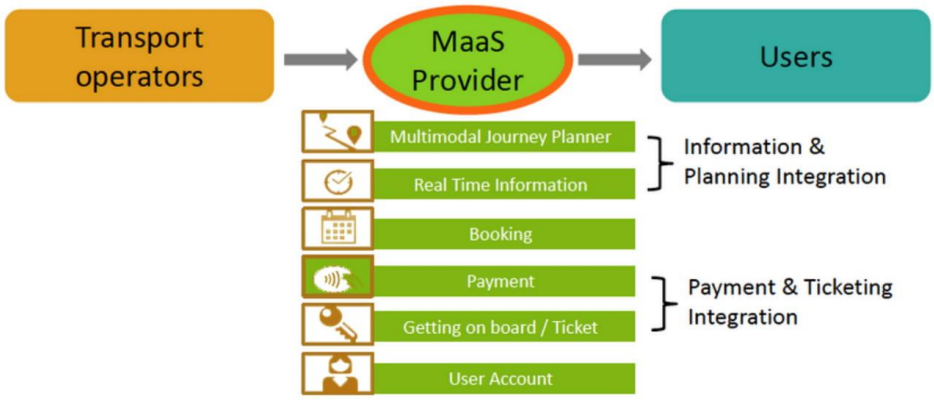
FUTURE OF SHARED MOBILITY

ACCESS VS. OWNERSHIP

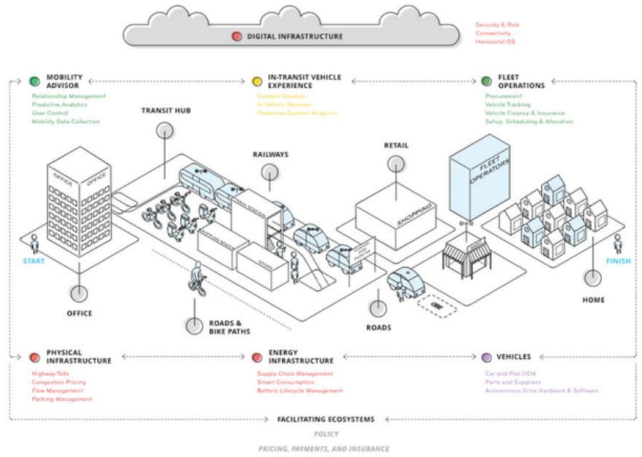
Deloitte University Study
(Jameson, Giffi, Vitale, 2016)

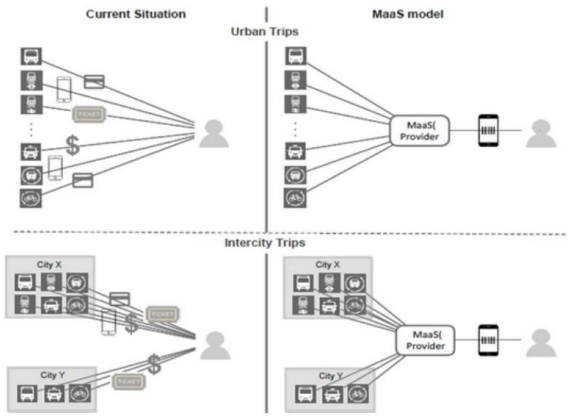


Mobility as a Service (MaaS)



Mobility as a Service (MaaS)





MaaS

"MOBILITY AS A SERVICE IS THE NETFLIX OF TRANSPORTATION"

Light	Medium	Premium	Pay-as-you-go
89€ /month	249€ /month	317€ /month	Try Whim without commitment and upgrade whenever you like.
Unlimited HSL Helsinki public transport + 1.000 Whim points	Unlimited HSL Helsinki public transport + 5.500 Whim points	Unlimited HSL Helsinki public transport + 8.000 Whim points	
Use your Whim points as you like, for example:	Use your Whim points as you like, for example:	Use your Whim points as you like, for example:	Transport providers:
2 taxi trips (~10 km/trip) daytime + ∞ unlimited local public transport	8 taxi trips (~10 km/trip) daytime + ∞ unlimited local public transport + 2 days of car rental	8 taxi trips (~10 km/trip) daytime + ∞ unlimited local public transport + 5 days of car rental	We get you to your destination using your preferred mode of transport, letting you pay as you go – all in one app!

Case Study: Helsinki MaaS

ERTICO ITS EUROPE

Press release
Bordeaux, France
5 October 2015
For Immediate Release

The European Mobility-as-a-Service Alliance has been launched

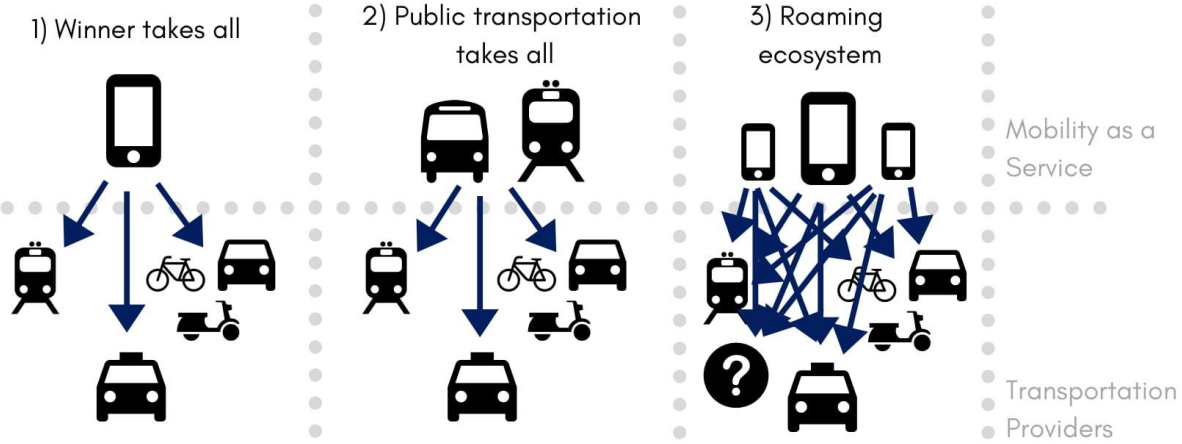
20 European organisations join forces to establish the first Mobility as a Service (MaaS) Alliance. This new initiative will work towards a truly European and common approach to MaaS through public and private stakeholder cooperation, providing the basis for the economy of scale needed for a successful implementation in Europe.

The key concept behind MaaS is to put the users, both travelers and goods, at the core of transport services, offering them tailor made mobility solutions based on their individual needs. This means that, for the first time, easy access to the most appropriate transport mode or service will be included in a bundle of flexible travel service options for end users.

Source: www.erticonetwork.com

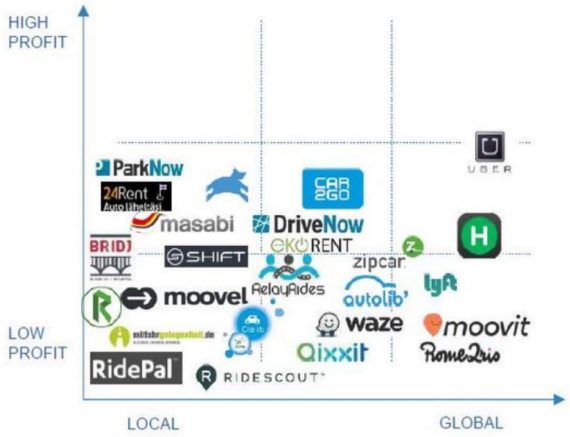
Three Ways to Evolve Markets

Study by Forum Virium Helsinki (Hietanen & Sahala, 2014)



Current Market Players

Study by Forum Virium Helsinki (Hietanen & Sahala, 2014)



The operator business model strives for scalable digital global business

Study by Forum Virium Helsinki (Hietanen & Sahala, 2014)

CONSUMERS	TRAFFIC OPERATORS	OTHER OPERATORS	CITIES AND THE STATE	OTHER COMPANIES

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First Phase 2016

Intended test area for MVP:

- HHT Growth Corridor
- Helsinki Region (HSL Traffic area)
- Turku and Turku region traffic area (9 municipalities)
- Tampere
- Tallinn

Helsinki MaaS

City Actions:

1) Discussion between stakeholders
2) Revision of legislation and regulation
3) Application of appropriate regulation
4) Deregulation of public transport ticket sales
5) Establishment of mobility operator market
6) Revision of purchase and suburbanization procedures
7) Piloting

Study by Forum Virium Helsinki (Hietanen & Sahala, 2014)

Lessons Learned

Study by Forum Virium Helsinki (Hietanen & Sahala, 2014)

- Be more flexible
- Cooperation across public sector
- Involve stakeholders outside your own organization
- Organizations may not be able to grasp new concepts outside departments' comfort zones
- Traffic planning vs Smart Mobility = focus on infrastructure vs focus on the function

"The City As An Enabler"

Study by Forum Virium Helsinki (Hietanen & Sahala, 2014)

FRAMEWORK

- Regulatory framework
- Legislation
- Strategies
- Monitoring and evaluation support for business development and investment

TOOLS

- Open data
- Open interfaces and APIs

UNIVERSITY–GOVERNMENT–PRIVATE SECTOR NEXUS

INNOVATION

- Innovative mindset
- Economic development through digitalization
- Mobility needs for vulnerable population (e.g. youth and seniors)

CONSUMERS

- Post-smartphone citizens

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Electric Vehicles

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LESSONS LEARNED FROM LAST CONNECTSMART WORKSHOP

- Growing optimism in the transport industry regarding CASE
- More understanding is required on how to prepare communities for adopting smarter transportation systems
- Focus group discussions raised questions, highlighting need for further understanding on policies, infrastructure **planning**, land use and equity issues
- Practitioners put together a **research agenda**, expressing the need of research before planning

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CONNECTSMART 2.0 PARTNERSHIP

1. Assess how Canadian communities are planning for connected, autonomous, shared and electric (CASE) mobility;
2. Explore mobility market dynamics, including households' mobility tool ownership, attitudes and preferences, anticipated adoption, willingness-to-pay and impacts; and
3. Engage in community-led scenario planning for identifying planning considerations, policy needs and risk management strategies for transportation and land use planning.

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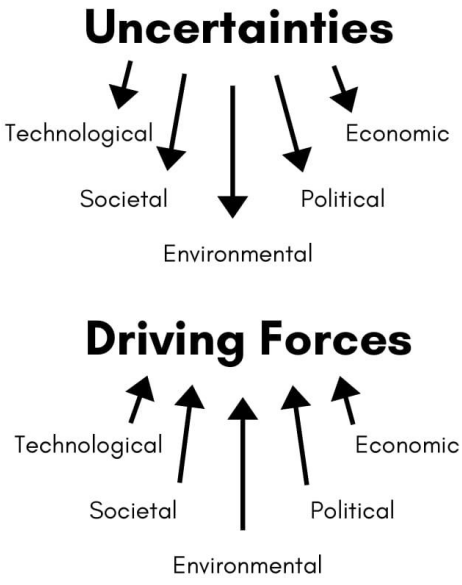
SCENARIO PLANNING

"SCENARIOS ARE NOT MEANT TO BE PREDICTIONS; INSTEAD THEY ARE PLAUSIBLE AND CONTRASTING NARRATIVES INFORMED BY TRANSDISCIPLINARY AND MULTI-STAKEHOLDER WORKSHOPS AND MEANT TO INFORM POLICY DEVELOPMENT FOR A SUSTAINABLE FUTURE."

– Steenberg, J., Duinker, P., and Creed, I.

Alternative scenarios for the future of Canadian boreal zone

SCENARIO PLANNING



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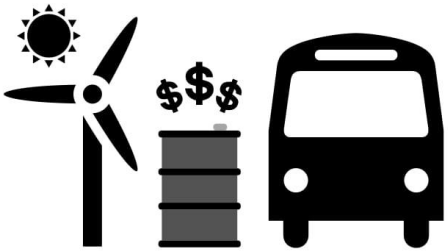
Case Study: United States in 2030

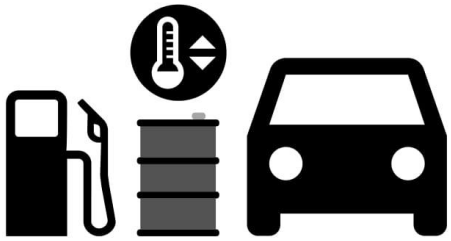
Study by RAND Corporation (Zmud, Ecola, Phelps, & Feige, 2013)

NO FREE LUNCH



- Strong regulations
- High oil prices
- National GHG-reduction policies
- Expansion of renewable and alternative fuels
- New zoning for greater densities, leading to increased transit use

FUELED AND FREEWHEELING



- Low oil prices and a booming economy
- Unduly affected by climate change but only locally
- No pressured to change energy policies
- Alternative fuel vehicles unpopular
- More sub-urbanization and traffic congestion
- Limited policies to mitigate climate change
- Worsening conditions of roads and bridges

THANK YOU

Questions?

Acknowledgement to the Connect2 Program, Department of Energy and Mines and my terrific graduate students and coordinators.

ACTIVITY 1

IMAGE A WORLD WITH CONNECTED, AUTONOMOUS, SHARED, ELECTRIC VEHICLES

- On **Post-it Notes**, individually draw how you see yourself in a future with **emerging CASE technologies**

A WORLD WITH CASE

(5 mins.)

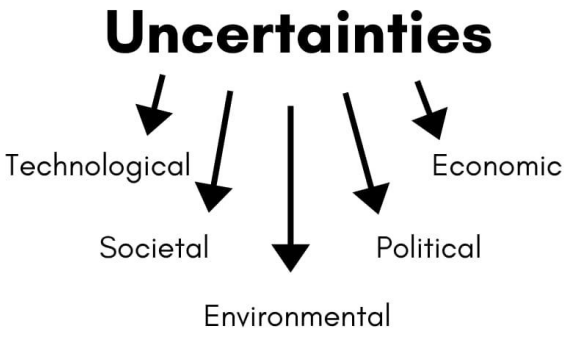
ACTIVITY 2

ANTICIPATING UNCERTAINTIES WITH CASE

- Forming groups, discuss what are some possible **uncertainties with CASE**
- Write your groups' answers on the **provided sheets** and place **under the appropriate heading**

UNCERTAIN FUTURE OF CASE

(20 mins.)



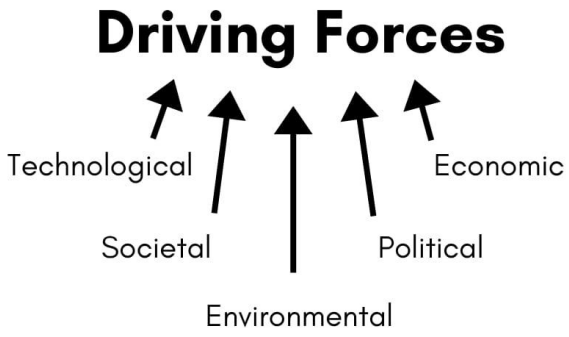
ACTIVITY 3

SKETCHING THE FUTURE OF CASE IN NOVA SCOTIA

- With your group, discuss what are some **driving forces** of **CASE mobility**
- Write your groups' answers on the **provided sheets** and place **under the appropriate heading**

DRIVERS OF CASE

(20 mins.)



ACTIVITY 1

SCENARIO PLANNING MATRIX

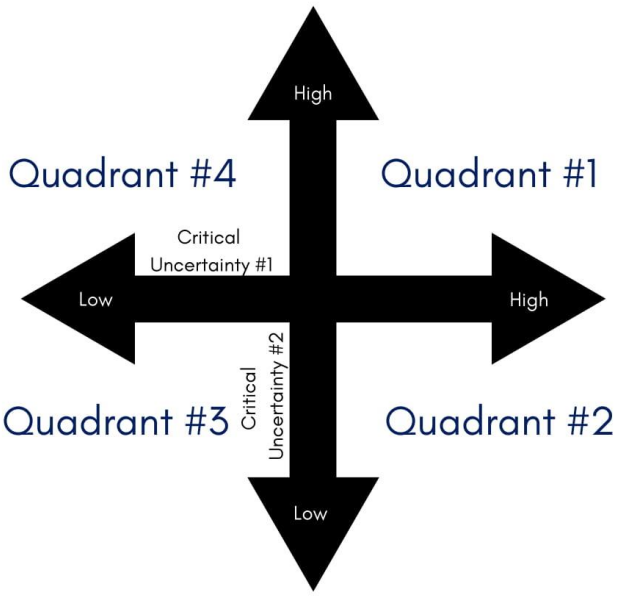
- First introduced by Kees Van der Heijden
- Useful for constructing and explaining uncertainties in a volatile situation
- Builds scenarios from and outside-in perspective

Activity

- Form groups based on your **scenario of interest**
- Your group will **identify key attributes** of this scenario if it were to occur in **Nova Scotia**
- Write in **point form** what this would look like

SCENARIO PLANNING

MATRIX TOOL



ACTIVITY 2

FUTURES WHEEL

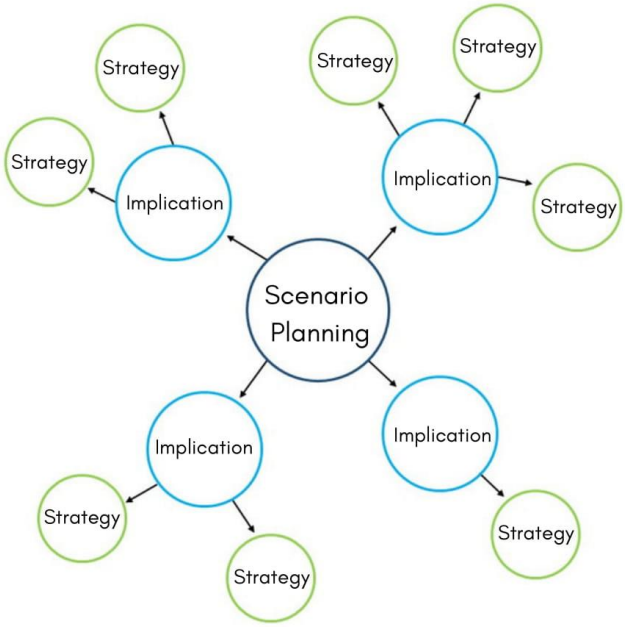
- The Futures Wheel was created by Jerome Glenn in 1972
- Used to identify potential consequences of events
- Useful tool for decision making and impact analyses

Activity

- With your group, fill in the **centre of the wheel** with your chosen scenario
- Building off of the scenario, identify the **implications of this scenario for Nova Scotia**
- Off of these implications, identify possible **no regrets adaptation strategies**

IMPLICATIONS AND STRATEGIES

FUTURES WHEEL
(20 mins.)



Developed off of Jerome Glenn's Futures Wheel.

ACTIVITY 1

CIRCLE OF SUPPORT

- Please fill in your name in the Circle of Support to help us form our Community Leadership Committee (CLC)

CIRCLE OF SUPPORT

(10 mins.)

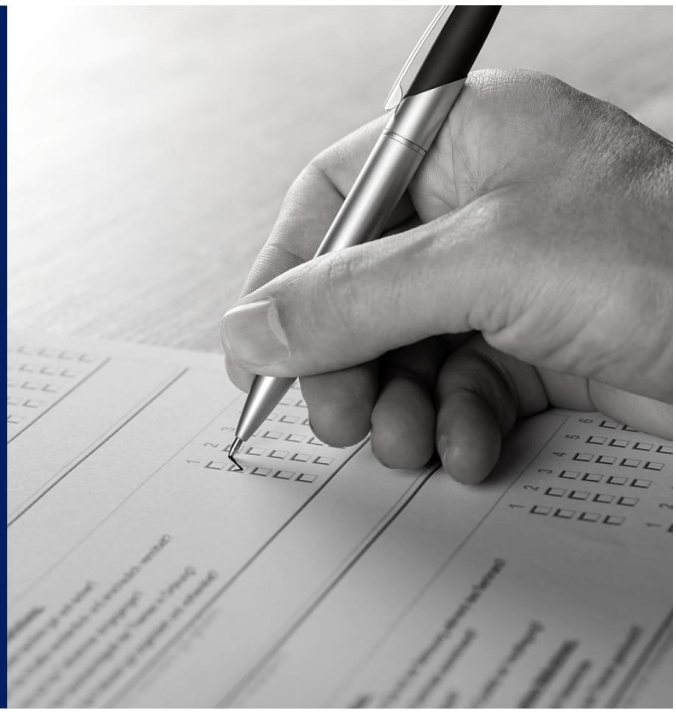
ACTIVITY 2

SURVEY

- Please fill in the workshop evaluation survey provided

WORKSHOP EVALUATION

SURVEY
(5 mins.)



Keep in Touch

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TWITTER

@DalTRAC

WEBSITE

DAL.CA/DALTRAC

REFERENCES

Corwin, S., Jameson, N., Pankratz, D.M., & Willigmann, P. (2016) The future of mobility: What's next? Retrieved from https://www2.deloitte.com/insights/us/en/focus/future-of-mobility/roadmap-for-future-of-urban-mobility.html

Hietanen, S., and Sahala, S. (2014). Mobility as a service: Can it be even better than owning a car? [PowerPoint]

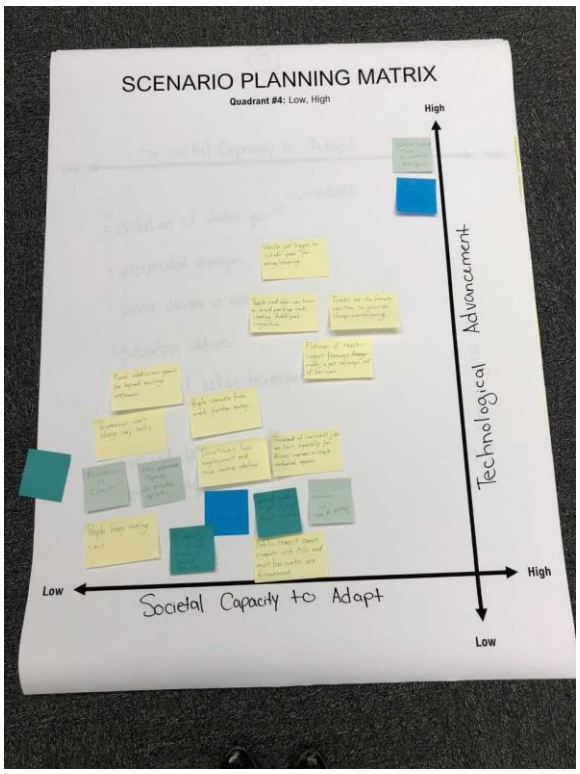
Steenberg, J., Duinker, P., and Creed, I. (2018). Alternative scenarios for the future of Canadian boreal zone. *Environmental Reviews*, 2-58. DOI: 10.1139/er-2018-0062

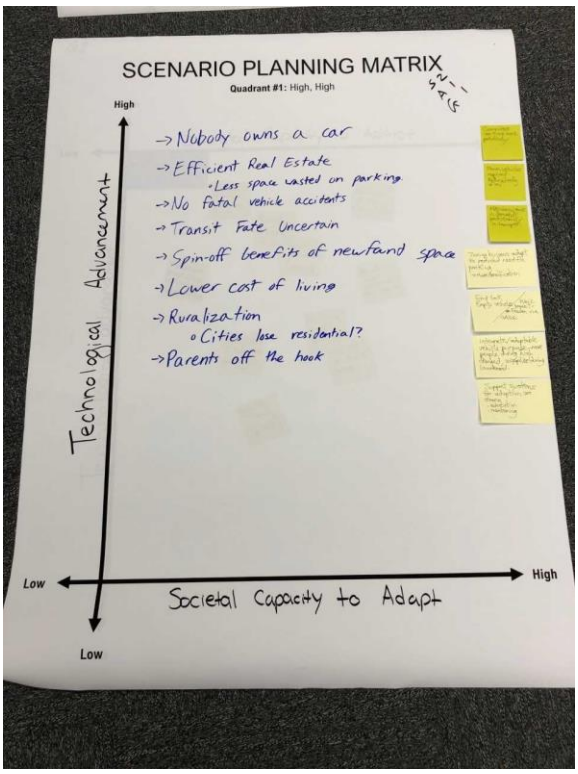
Wulf, T., Brands, C., & Meissner, P. (2010). *A scenario-based approach to strategic planning: Tool description-scenario matrix* (Working Paper No. 98). HHL, Leipzig.

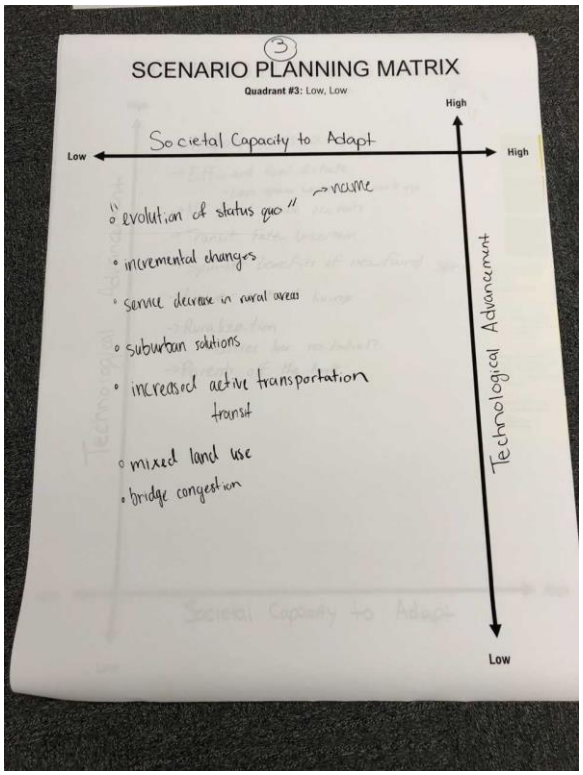
Zegras, C., Sussman, J., and Conklin, C. (2004). Scenario planning for strategic regional transportation planning. *Journal of Urban Planning and Development*. 2-13. DOI: 10.1061/(ASCE)0733-9488(2004)130:1(2)

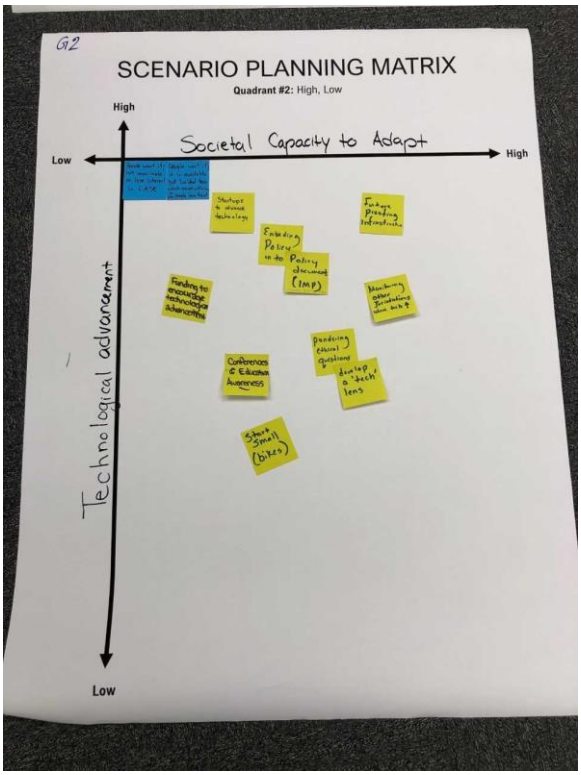
Zmud, J., Ecola, L., Phelps, P., & Feige, I. (2013). The future of mobility: Scenarios for the United States in 2030. Retrieved from RAND Corporation Website: https://www.rand.org/pubs/research_reports/RR246.html

Appendix B: Matrix Quadrants









Appendix C: Raw Workshop Results

The participants came up with the following responses for the session activities.

	Group 1	Group 2	Group 3	Group 4
Session 1				

Activity 2: What uncertainties of CASE are you anticipating?	• Policy
	• Loss of privacy
	• Loss of individual autonomy
	  ○ Restrictive
	• Social acceptance
	• Price volatility (demand-based price)
	• Availability/ sufficient supply
	• Electric grid capability
	• Cyber security
	• Infrastructure
	  ○ Especially in northern places (snow)
	• Ethics
	• Social buy-in, able to withstand accidents/negative press?
		• Will bedbugs scare people off carsharing or ridesharing?
		  ○ i.e. will the cars be clean inside?
		• Will parents with children be willing to forego car ownership?
		• Emergency situations
		  ○ Network break
		  ○ Avoiding evacuation zones
		  ○ Should emergency vehicles ever be autonomous?
		• Safety and security with other passengers
		  ○ e.g. assault
		• Individual cost/benefit
		  ○ Will ownership be more expensive than CarShare?
		• Will employers scale back on CarShare programs?
		• Will service providers pay for use of roads?
			• Privacy concerns
			• Who owns the data?
			• Technological uncertainty
			• Urban sprawl
			• Social aspect
			• Not concerned about cost
			• Policy concerns
			• Impact on other modes of transportation
			• Impact to quality of life
			• Legacy technology + holdouts
				• Insurance/Liability
				  ○ Infractions wo pays?
				  ○ Vehicle manufacture
				  ○ Municipal/provincial infrastructure
				  ○ Network providers (network security)
				  ○ Power providers
				• Climate
				  ○ Performance during weather events
				• Age restrictions
				  ○ Do you need a license?
				• Reduced collisions/infractions?
				• Increased congestion? Increased VKT?
				• Refueling, charging, servicing
				• How will this work for families?
				  ○ Car seats, pets, other
				• How would it work in rural areas?
				• Accessibility (Physically? Financially? Geographically?)
				  ○ Equitable access?

Activity 3: What are the driving forces of CASE mobility in Nova Scotia?	• Price accessibility
	• Electric energy source
	• Cost of carbon (carbon tax?)
	• Public sector
		• Government
		  ○ Funding/rebates
		  ○ Will governments dare to apply variable electronic road tolls?
		• Infrastructure
			• ~~Uber~~ → in NS right now
			• Rich people
			• Industry
			• Politicians will resist →
				• Optimized route arrival departure travel time
				• Safer
				• Technology
				  ○ Safe autonomy
				• Convenience
				  ○ Connected

- Removal of prohibitive legislation
- Aging population
- Safety
- Densification
- Emission reduction targets
- Reliable
- Enabling technology accessible
- Enabling legislation
- Appetite for discretional use of time

- EV charging stations abundantly available?
- Gas stations adapting to EV charging needs?
- Demographics
  - Seniors
  - Will people move farther out because commuting is easier?
  - Millennials (ability to afford?)
  - Will people be able to do more errands on foot?
- Market
  - Will truck platoons put railroads out of business?
  - Will retailers be willing to provide less parking?
  - Will public transit keep pace with AV & battery & IT innovations?
- Culture
  - Car culture
  - Most people LOVE to drive!
  - Parking culture – "where can I park?" and stress
  - Passion for driving/luxury of driving

negative driving force
- Global will influence NS
- Apps
- Big data companies
- Shipping goods
- Keeping up with national trend
- Rural can be innovative for NS

- Sustainability
  - Electric
- Regulation/policy changes
- Tourism & economic development
- Profit
- Insurance
- Fuel cost
- Car ownership cost
- Cost to drive
- Economics
  - Total cost of ownership for owning EV.
  - Cost of transportation/km for autonomous shuttle & car share
- Parking
  - Space saturation
  - Autonomy
- Urbanization
  - Shared autonomous
- Charging infrastructure
- Vehicles availability
- manufacturer

Session 2

Activity 1: Build the scenarios

Quadrant 1	Quadrant 2	Quadrant 3	Quadrant 4

• Nobody owns a car
• Efficient real estate
  ○ Less space wasted on parking
• No fatal vehicle accidents
	• People want it; not available so lose interest in CASE
	• People want it; it is available but limited tech. which causes collisions and people lose trust
		• "Evolution of status quo"
		• Incremental changes
		• Service decreases in rural areas
			• No trust in tech
			• Loss of privacy
			• Lack of investment in pedestrian, cycling, and transit infrastructure
			• Slow economy
			  ○ Loss of jobs

- Transit fate uncertain
- Spin-off benefits of newfound space
- Lower cost of living
- Ruralization
  - Cities lose residential?
- Parents off the hook
- Commuters use time more productively
- Fewer vehicles required (reduced manufacturing of motor vehicles)
- Efficiency gains in demand predictability around transport
- Zoning bylaws adapt to reduced need for parking
  - More densification
- Grid lock, empty vehicles
- Public transit-feeder via CASE
- Integrate/adaptable vehicle purpose
  - move people during high demand, supplies during low demand
- Support systems for adoption are strong
  - Education
  - Mentoring
- Start-ups to advance technology
- Funding to encourage technological advancement
- Embedding policy
- Policy documents (e.g. IMP)
- Pondering ethical questions
- Conferences & educational awareness
- Start small (e.g. bikes)
- Develop a 'tech' lens
- Monitoring other jurisdictions where tech is
- Future proofing infrastructure
- Suburban solutions
- Increased active transportation and transit
- Mixed land use
- Bridge congestion
- No capacity for universal income to combat job loss
- People keep owning cars
- Resistance to change
- Slow government response
- No proactive approach
- Government won't charge any tolls
- Rural subdivisions sprawl far beyond existing settlements
- People commute from farther away
- Downtowns lose employment and town centres decline
- Public transit cannot compete with AVs and most bus routes are discontinued
- Thousands of low-skill jobs are lost, especially for drivers, couriers & mechanical repairs
- Platoons of trucks congest freeways, damage roads, & put railways out of business
- Trucks use the freeway system to provide cheap warehousing
- People send their cars home to avoid parking costs, creating double-peak congestion
- Vehicles get bigger, to include space for eating/sleeping
- World leading tech research from Dal
- Good wireless network coverage

Appendix D: Workshop Evaluation

ConnectSmart Scenario Planning Workshop Evaluation

1. Were you familiar with smartphone app-based on-demand mobility services prior the workshop? (e.g. Uber, Lyft)
    a. Yes, I have heard of them and used them elsewhere.
    b. Yes, I have heard of them but have not used them.
    c. No, I have never heard of them.
2. Were you familiar with scenario planning prior to this workshop?
    a. Yes, I have heard of scenario planning and used it before.
    b. Yes, I have heard of scenario planning but have never used it.
    c. No, I have never heard of scenario planning before.

On a scale of 1-5 where 1 is **strongly disagree** and 5 is **strongly agree**, please circle the most appropriate answer:

3.	The workshop content was relevant, comprehensive and easy to understand.		1	2	3	4	5
4.	The activities were useful learning experiences.		1	2	3	4	5
5.	I will take what I learned at this workshop back to my organization and share it with my peers/coworkers.		1	2	3	4	5
6.	The workshop lived up to my expectations.		1	2	3	4	5
7.	I am excited to be apart of the CLCs.	N/A	1	2	3	4	5

8. What did you **like best** about this workshop? _____

_____

9. What did you **like least** about this workshop? _____

_____

10. Additional Comments:

_____

_____

_____

_____