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RESPOKING THE HUB

Updating a 19th century public transit system
for a 21st century Boston



Hans Cruse

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Supervisor: Barry Ness

LUMES, Lund University

ABSTRACT

Institution / Program:	LUCSUS, LUMES
Address:	Sölvegatan 10, Lund (postal address Box 170, 221 00 Lund, Sweden)
Telephone:	+46 (0)46-222 8080

Supervisor:	Barry Ness
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Author :	Hans Cruse

This thesis analyzes what the major challenges are for Boston to transition to a more sustainable transportation network. Data was collected through a mixed methods approach, using qualitative interviews and a literature review. A short background of current and past challenges in the infrastructure of Boston is provided for the reader as a backdrop of the challenges faced by interest organizations and planners.

Using transition theory, the data collected in the interviews was analyzed and the actors mapped in a multi-level approach. Throughout the analysis section, individual issues revealed are listed and analyzed together with suggested actions to improve the situation in Boston. The conclusions are that more collaboration is needed between grass roots groups, that oil prices can be both a trigger and driver to change, there is a need for overarching plans as well as a holistic picture to address a great number of problems that can arise from a need to restructure the transportation system and finally; a need to develop or find good evaluation methods to analyze what is working in a new system and what is not.

Keywords: Boston public transportation, transition theory, governance, transition management, land-use, community development

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INTRODUCTION

Many places in the United States today deal simultaneously with problems such as urban sprawl, traffic congestion and pollution issues; Boston is no exception (Atash, 1996). However, with fluctuating oil prices and surfacing environmental concerns, it becomes clear that the transport sector will need to change in the future. It is still unclear how this change will develop, nevertheless it is an excellent opportunity to drive development in the direction we want it to go, pushing us away from the technological and societal lock-in that oil dependency has put us in.

There are, of course, many changes that will need to take place in order to create the change required to reduce our oil dependency. In this thesis however, I have chosen to focus on passenger transportation and the actions that can be taken to create a more sustainable transportation sector. Public transport is essential to ensure that people can travel within the city for both work and leisure without depending on their cars.

Boston was selected as the focus of this thesis for many reasons (some were pragmatic in nature, such as finding living quarters and means of transportation for myself). More importantly however, Boston is a historic city with the US's oldest subway system built underneath it. This old and – sometimes under dimensioned infrastructure - presents additional technological challenges for transportation and city planners. There are many narrow streets throughout this historic city so car drivers, bus drivers, bicyclists and pedestrians all compete for space.

It must be remembered that Boston is however, more than just one major city; with the Atlantic Ocean bordering the east, the metropolitan area consists of 101 towns and cities (Metropolitan Area Planning Council, 2010a). For this thesis, to facilitate the ease of comprehension of my argument, I have chosen a three-level approach for my investigation (town, region and city) to showcase the challenges facing decision-makers on each level.

Boston itself is comprised of several somewhat independent cities, for instance Cambridge, Boston, Somerville and South Boston. Each city has separate policies (i.e. development, building or transportation) to some extent (which will become apparent later in this thesis), which dates back a time when the cities were separate entities before they merged together. This will provide interesting challenges in the years that lie ahead. How can Boston's transportation system be reformed to better fit people's needs, and how can people's needs be reformed to fit the transportation system? How can we deal with potential social injustices when the transportation system changes?

PURPOSE AND RESEARCH QUESTIONS

Transportation is a vital part of our society today and we are travelling more and more. This increased mobility is beneficial, but also presents a major problem for society. The transport sector emits a number of different pollutants in large quantities, and in the United States; 27% of all CO₂ emissions (CO₂ being an important greenhouse gas) come from the transportation sector (Lei et al., 2009). Recognized benefits of technological advances in emissions reductions aside, if demands from transport can be reduced large gains can be made in the endeavor to reduce human impact on the global climate.

The objective of this paper is to analyze some of the major challenges facing Boston in implementing a more sustainable transportation network. Transition theory was selected as the main analysis frame for this thesis as it recognizes the need for a differentiated approach and not a 'one size fits all' solution. It is relevant from a sustainability science point of view to use this framework to understand how change works, and how to influence the system. Sustainability science, being a transdisciplinary field (Kates et al., 2001), is ideal to analyze the questions below.

RESEARCH QUESTIONS

- How are the different actors in Boston connected to each other and on what level in a multi-level perspective do they act?
- What are the major inhibitors and proponents to change in metropolitan Boston and how can these be influenced?

- What are some of the issues that need to be acknowledged for a transition to develop?
- How can transition theory be used in managing and understanding a transition in Boston and what are the different paths change can take in Boston?

DISPOSITION

This thesis continues by describing the approach taken to study the topic. Methodology is described as well as the rationale for using these particular methods. The theoretical framework is then presented, after which a brief presentation will be given on some of the infrastructural challenges Boston faces today. After the background of Boston the analysis and discussion section follows. This key section is where I will answer my research questions, and is split into several subsections, presenting the results from the interviews, localizing actors in the multi-level model, as well as the analysis of a number of issues noticed by my work. Last is the conclusion, which is a re-cap of the main points of the paper, and also an area where future research is suggested.

STUDY APPROACH

This thesis is based on a mixed methods approach: using qualitative interviews conducted with key persons on site in Boston, as well as a literature review connected to the study. I contacted potential interviewees directly, having either identified them by browsing the appropriate organizations websites or by being referred to them from a different interviewee (the snowballing method). The interviews were semi-structured, which meant that I had both an outline of topics that I wanted to cover during the interview and suggested questions (Kvale and Brinkmann, 2009). This allowed the interviewees to take me in directions that I had not originally considered, showing me their reality and clarifying the problems from their point of view. This was extremely important; as I wanted to recount the transport issues in Boston according to someone living and working in the area since they have a better knowledge of the problems in the city than outsiders.

LITERATURE REVIEW

Before undertaking the interviews, I first had to position this paper amongst the existing literature on the topic. A number of related studies have been made; however, with few exceptions, very little research has been carried out on Boston. One of the most prominent and encompassing articles is the Tellus scenarios report, which focuses on Boston specifically (The Tellus Institute, 2008). It is a narrative story, which describes three different scenarios; business as usual, policy reform and the great transition. It considers what went wrong in the first two scenarios, and proposes the completed transition as a desired future Boston. It also suggests potential traps with the scheme and how best to avoid them. The scenarios were used as a tool in my interviews as my interviewees were more familiar with these scenarios than with transition theory in general.

The Metropolitan Area Planning Council (MAPC) has constructed other interesting scenarios called MetroFuture, which center on Boston. These were constructed by interaction between the public and city planners in the towns throughout the MAPC, and

provide their visions for the future of Boston (Metropolitan Area Planning Council, 2008).

There is more literature on single issues in Boston. For example Beaton (2006) describes the impact commuter rail has had on communities in the suburbs and draws the conclusions that those areas that first got commuter rail in the 1970s are more prosperous and densely populated than the other lines. In other infrastructure projects, Hansen (2009) describes the challenges faced when building the Boston subway in the late 19th century (many of which still hold true today) and Garvin (2007) considers the evolution of the main roads in Boston.

There is also a great deal of literature dealing with land-use, planning and their implication on transportation. Atash (1996) describes how urban sprawl has influenced transportation policies in the US in general, and how planning should be changed to accommodate new transportation options. Brown et al (2009) in examining how highways have been constructed in the past and how funding has changed throughout time, make interesting points about highways' high social impact. Further articles on planning include those written by Newman (1995) and Haltiwanger et al (2010). The latter of which investigates if big-box stores¹ are outcompeting smaller stores. This is relevant for Boston (especially the outlying suburbs) when it comes to allowing commercial establishments.

The literature on trends and attitudes is also relevant for this thesis. Nowland et al (1991) conducted a study on downtown Toronto and concluded that people moving into the downtown area will reduce their number of car trips. Ibrahim (2003) undertook another relevant study (albeit not in North America) and tried to understand the social mechanisms behinds peoples' modal choice (i.e. how they choose to travel) when they go shopping.

A number of newspaper articles (i.e. grey literature) reporting incidents in relation to the Boston public transit system were also studied - especially those dealing with safety

¹ A big box store is a large retail store, operated by large chains. (Haltiwanger et al., 2010)

issues or accidents - with the aim of providing a greater insight into the current issues and priorities in the public transit system.

Lastly, some literature was studied on how to evaluate whether projects are working. Litman (2003) is especially interesting as it had a unique approach to measuring success, something I will delve into deeper later in this thesis.

Many more articles were studied but were found not to have a large significance to this thesis. Despite their omission from the final paper, they sometimes provided inspiration on direction and questions to ask my interviewees.

Interviews

The following people were interviewed for this thesis: Jeffrey Rosenblum - City Planner from Cambridge, Eric Bourassa – Transportation Manager at the MAPC, Clark Brewer – architect and a member of the Cohasset Planning Board, Jackie Douglas – Director of the Livable Streets Alliance (NGO), James Goldstein – Senior Fellow at the Tellus Institute and Ken Kruckemeyer – Transportation Strategist, currently teaching at MIT. I chose these interviewees because they all have a unique insight into transportation issues in the Boston area and provide an interesting and nuanced picture of the apparent lack of process in Boston when it comes to the issues of sustainable transportation, and what measures must be taken for change to come about. Each interview lasted between 1 and 2 hours. A short biography on each of the interviewees is available in the appendix of this paper. Transportation end users were not directly addressed in this paper as two of the organizations (the MAPC and LivableStreets) already represent them.

Interviews were not recorded as my experience has taught me that interviewees sometimes can get nervous and focus more on the recording of the interview instead on what they want to say. However, notes were taken during the interview. Each interview was transcribed in bullet point form as soon as possible after the interview was completed. Kvale and Brinkmann (2009) states that this approach to interviewing might be disruptive to the interviewee and disrupt the free flow of conversation. However, as mentioned above, I have found recording the interview more disruptive as participants

tend to be more careful with what they say. If an interviewee makes a mistake, they worry that this has been recorded, stored and can potentially be used in a manner that the interviewee has no control over. There are ethical implications of using material against an interviewee's will; however, there is no guarantee that the researcher will not use their misinformation and hence the interviewee might be hesitant to open up. When using notes to record the interview, interviewees can clarify their statements if they wish. Interviews were also used to limit the scope of the thesis in terms of time, as interviewees mostly addressed Boston at most 50 years into the future.

Finding interviewees turned out to be more problematic than I initially envisaged. It was easier to contact informants on location in Boston than it was from home. I received very few replies to my requests for information, both those sent by email and those by making phone calls. Frequently potential interviewees were not available or simply ignored my request for a meeting. This presents some bias in my interviews, as all my interviewees feel that the transportation system is flawed and want it changed. They were, therefore, eager to share their ideas with me. In addition, it also skewed my selection process somewhat since I was using snowball sampling; meaning that I was referred to new interviewees by my previous subjects (Polkinghorne, 2005). This method was flawed in the sense that it did not provide the spread in opinions that I had originally hoped for.

There are many possible reasons as to why so relatively few interviewees agreed to participate in the study. One of the reasons might be the ever-changing nature of thesis work. My research questions were dynamic, and this fluctuation could have been intimidating for the interviewees as they may have been uncertain as to what I was going to ask. The ever changing questions also lead to some personal confusion at some points, which may have resulted in me not being able to give a clear presentation of the project. Another reason might be that the potential participants felt that I, as a researcher, was there to poke holes in their decisions and ask difficult questions that they could not answer.

Kvale and Brinkmann (2009) state that the interviewer can be either a miner or a

traveler. The miner mines after information in a very structured manner, while the traveler pieces together information letting the interviewees take the lead and following them around in their story. In this thesis, the latter category is more applicable as I did not have a clear idea of the situation in Boston before I started my interviews, and therefore needed to construct a deeper understanding. Having lived in the area of Boston for a couple of years certainly helped in creating this understanding, and having lived there was yet another reason Boston was selected for the study as I experienced the transportation system from an end-user perspective.

Being so few, my interviews were not coded in a conventional manner (i.e. using computer software), as the benefits from doing so would be limited when compared to the amount of time it would have taken. Instead, the interviews were entered into a word processor, which facilitated a clearer overview.

Knowing that the thesis would be based on transition theory, I actively set out to find interviewees which represented an even spread among the different levels in the multi-level approach (town level, city level and the metropolitan level). One interviewee would usually refer to at least one other of my other interviewees, which allowed me to figure out how the actors on these different levels interact with each other. For instance, Clark Brewer (2010) referred on a number of occasions to the MAPC where I later interviewed Eric Bourassa (2010).

The interviewees in this paper often mentioned specific actors that they thought were either obstructing change, or progressing it. In the analysis section of this paper, these actors will be localized within Geels' network in order to understand how they influence each other and how they can be influenced.

Using qualitative methods combined with a multi-level framework suggested in transition theory, explained further below in the theoretical framework section (Geels, 2002). I believe this is the most appropriate methodological approach for this thesis. A quantitative data collection would not have given me the same depth of understanding of the problems in Boston and I may also not have been made aware or gained access to

the people I did interview since I need to build a kind of personal relationship where the interviewees trust me in order to point me in the right direction. Using this method also gave me the opportunity to introduce my project properly to potential interviewees, giving them a chance to make an informed decision as to whether or not they wished to participate. It also allowed me to gain relevant insights into the issues Boston is struggling with and position the actors in relation to each other.

Theoretical Framework

There are several strands of transition theory. They are all similar to some extent; however in this thesis, the theoretical core will be based on the theories provided below. Rotmans et al (2001) present the first important concept, they define transition by drawing parallels to demographic transitions. It is a slow continuous process where some elements of society change over a long time. Governments and policies cannot control this process entirely, as they contain many different possible outcomes. They can, however, be influenced from policy choices. Loorbach et al mention two different forms of transitions, *evolutionary* transitions, where change does not follow any pre-determined plan and *goal-oriented* transitions, where necessary steps are required to reach predetermined goals (Loorbach and Rotmans, 2006).

A transition consists of several stages: predevelopment, take-off, acceleration and stabilization. Predevelopment is the initial phase where little change occurs. In the take-off phase, change gets underway. When the system is under sufficient pressure and is no longer able to maintain the status quo, this change accelerates. The acceleration or breakthrough stage takes place once change has accumulated in a number of different sub-systems and these changes start reacting to each other. Finally, the stabilization phase is established when a new equilibrium is found and the pace of change is reduced (Rotmans et al., 2001).

In short, a transition is a co-evolution between different areas of a society, such as policy and infrastructure. These different parts reinforce each other, as change does not occur at the same pace for all the different elements of society (for instance change can be faster in the economic system than in the cultural system) (Rotmans et al., 2001, van der Brugge et al., 2005).

It is important to keep in mind that change can fail in the transition theory model, and the whole or parts of a system might collapse if change fails to take off. Backlash can also become a problem when changes are implemented or change is not occurring fast

enough (for instance slow implementation of faster buses or more fuel efficient vehicles). Technological lock-in is also a threat to change as seen in the figure below. (Loorbach and Rotmans, 2006).

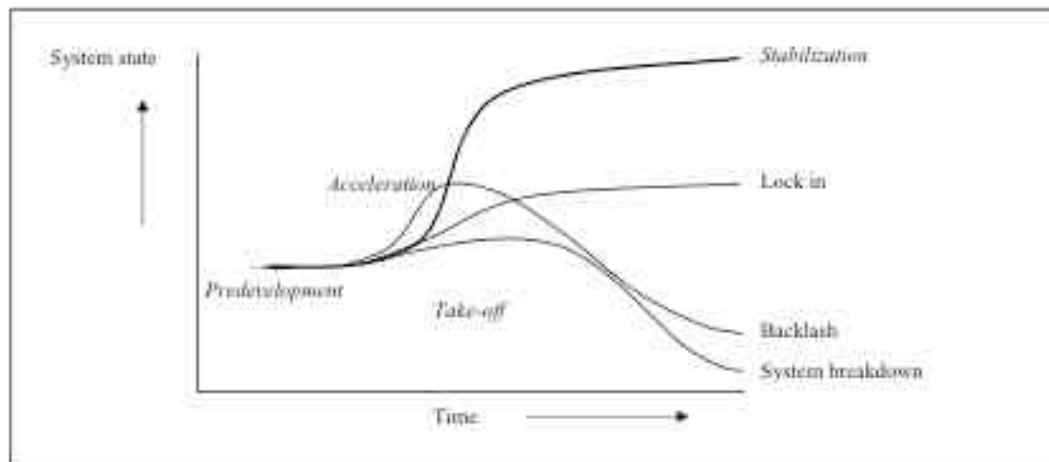


Figure 1 – The figure illustrates where the different stages of a transition are, and where they are located in time in relation to each other. The diagram also shows what different kinds of failed transitions looks like, such as backlash, system breakdown and lock-in. (van der Brugge and de Haan, 2005)

In connection to transition theory, Kemp et al (2007) present five different potential problems in managing transitions, which are important to keep in mind when reading the analysis part of this thesis:

- Dissent – Different actors in the system disagree on definitions or sometimes the nature of the problem.
- Distributed Control – The government cannot manage everything because there are many actors that are autonomous and independent of state control. Kemp et al (2007) call these pluricentric societies (societies with more than one core).
- Determination of Short-term Steps – It is difficult to identify what short-term steps can be taken in order to build a long-term transition by stakeholders.
- Danger of Lock-in – There is always a danger of prematurely selecting a technology, investing a great deal of time and money and then discovering that a better technology would become available.

- Political Myopia – A transition can take up to two generations to complete, and is therefore subject to changes in the political scene such as elections (Kemp et al., 2007).

Another important concept used in transition theory is the multi-level approach presented by Geels (2002). He proposes that in order to understand transition theory, we must acknowledge that change can take place on three conceptual levels; *landscape*, *regime* and *niche* (Geels, 2002).

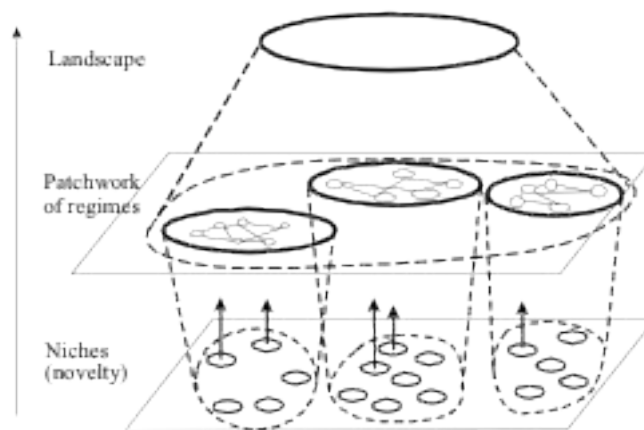


Figure 2 – Geels' nested hierarchy. This figure illustrates how niches as individual actors or clusters can move up to the regime level. It also illustrates that society consists of not only one regime, but a patchwork of them. In this model, Geels is also illustrating how the landscape level shapes the regimes, preventing change from happening. (Geels, 2002).

The *landscape* level (also known as macro-level) is slow changing; it consists of external factors, and decides in what direction development should go. Deeply rooted in society and consisting of large exogenous factors, which influence the regimes and niches below it, this level is not easily influenced. Using the metaphor of a landscape, Geels illustrates the difficulty of rapid change at this level but the possibility of change over time. On this level you will find infrastructure such as roads, railroads and airports, as well as trade agreements and cultural beliefs (Geels, 2006).

The *regime level* (or meso-level) consists of a large number of actors such as social groups, but also includes companies and governments. These groups interact with each other and steer development along a “technological trajectory” (Geels, 2002). The development occurring at this level is a product of the technological trajectory

established by the landscape level, (i.e. the landscape level creates a technological lock-in which means that regimes resist change and innovations) consequently these regimes create stability (Geels, 2006).

Finally, as there is little scope for radical innovation at the regime level, as any innovation occurs in the *niche level* (also known as micro-level). Innovations are vulnerable in a number of different ways: for instance from market pressures or current technological lock-ins. An area of few regulations, technologies can advance and gather support at the niche level, protected from the influence of external actors. Despite innovations often being designed to counter a problem in the current regime, the stability of the regime level may prevent an innovation from entering a regime and either replacing or improving an established technology. However, the regime may become unstable and this is when an innovation can be absorbed into the regime level. (Geels, 2006).

Geels argues that the technological trajectories which exist in the landscape level do not alter very easily (Geels, 2002). This means that our current landscape or society (including values and infrastructures) adjusts very slowly and unless the process of change commences before our current regime becomes a problem (i.e. we run out of oil), we might not be able to adapt in sufficient time for our society to avoid breaking down.

To provide an additional analytical framework in this thesis, the Tellus Institute's scenarios on Boston were used as a supplementary frame of reference: especially those scenarios that conceptualized different kinds of change, such as business as usual (no change), policy reform (what is described above as technological lock-in) and the deep change scenario (a completed transition) (The Tellus Institute, 2008). This framework is similar to transition theory; however it is localized to Boston and specifically deals with local issues, hence it was useful when interviewing as the interviewees were more familiar with this report than with transition theory.

CASE STUDY BACKGROUND: BOSTON

It is important that the flaws of the current Boston system are understood if we want to provide solutions and encourage people to take a different modal choice, to that end I will outline some of the existing problems and challenges in Boston. I will also describe one the largest infrastructure projects that the city has dealt with in recent decades to show that it is possible – if the political will and political incentives are present – to undertake substantial projects even when running a budget deficit. As this thesis is not considering air traffic, the airport is left out of this description.

The current regional population is approximately 4.5 million, and is projected to grow to almost 5 million over the next 20 years (Metropolitan Area Planning Council, 2006). It is also worth mentioning in this context that the town of Cohasset that this study also focuses on is an old town dating back to the colonial 1770s and is predominantly residential. This is a small town with a population of just 7000 (Massachusetts Department of Housing and Community Development, 2000).

Every day, more than 600 000 trips are undertaken in the city using the subway and commuter rail, with the busiest station being Harvard Square that is the destination of a number of students, residents and tourists (Metropolitan Area Planning Council, 2010b). In 1996, there was a daily influx of 575 000 commuters coming in from the suburbs (The Boston Redevelopment Authority, 1996) and this is not a number that has likely been reduced since then.

Traffic congestion is plaguing all the highways around the city; increasing commuting time from some suburbs to over 40 minutes each way and this keeps increasing, even as more people use public transportation (Greenberger, 2004).

The central artery project

This sizeable infrastructure process is well known in Boston as ‘The Big Dig’. The goal of the project was to bury the old elevated central artery, which divided the city. This original artery was opened in 1959, but very soon after opening was criticized for being

unsafe and slow, with the congestion it was supposed to alleviate being just as bad as before (Garvin, 2007).

The idea of a tunnel was brought to decision-makers as a way of increasing capacity and re-uniting the neighborhoods split by the construction of the original central artery. Construction started in the early-1990s, and was 90% finished by 2007. The project was originally projected to cost just under US\$ 3 billion, but by its conclusion cost almost US\$ 15 billion. This budget overrun was caused by a number of reasons including environmental and aesthetical concerns. Today, space previously occupied by the central artery is wide open and used for parkland. No definitive use for the open land has been decided upon. (Garvin, 2007).

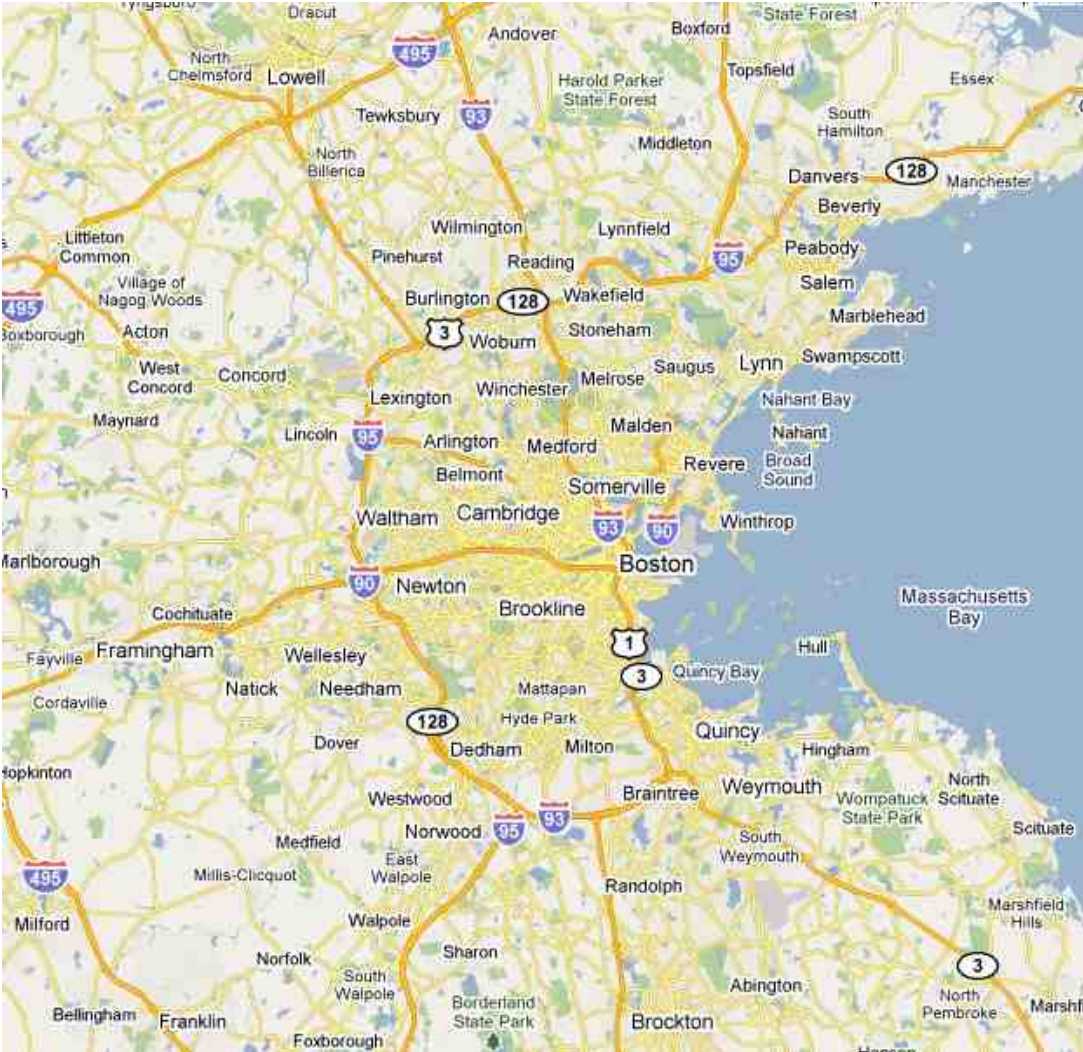


Figure 3 – This map shows the principal highways in Boston. Highways 495 and 128 constitute the major beltways around the city, while routes 93, 95, 1, 3 and 90 are the major “feeders” to the city. (Google Maps, 2010)

Some smaller projects that formed part of the Big Dig have yet to be completed, which is problematic from a sustainable transportation point of view as an aim of the project was to improve services to encourage people to use public transportation. One of the more well known projects is the Red Line / Blue line connector which was supposed to link these currently unconnected subway lines by extending the blue line for about 500 meters (Massachusetts Department of Transportation, 2009a). However, this project was postponed due to budgetary constraints (Bierman, 2009).

Subways

The Boston subway was constructed to alleviate congestion in the 1800s, after a wave of immigrants came to the shores of Boston. The first line was the green line, running alongside the Public Garden and Boston Common (Hansen, 2009). Although this line has been expanded and branched out over the years, the original stretch is still in service, which poses a problem in relation to modernizing and maintaining the subway system as the tunnels are limited in size and capacity.

In much of the literature studied for the literature review for this paper it becomes apparent that the subway system is far behind in necessary maintenance and expansion schedules and that this needs to be corrected. A result of the lack in maintenance, a number of incidents have happened over the last years, the latest one in April 2010, where old electrical wiring caused a fire, which injured 20 people. This was the second fire in a short period (Moskowitz, 2010).

Another factor, which may contribute to accidents, especially on the oldest line in Boston, are the poor quality safety systems. Over the last few years two serious incidents have arisen on the green line alone; one the accident was caused by speeding and the other by a driver who was texting and not paying attention (Valencia and Bierman, 2009).

The problem is, of course, only partially a technological challenge; as long as humans are a part of the system there is no way to eliminate the possibilities of human error. Nevertheless incidents in Boston's aging subway such as those mentioned above may

prove to be an obstacle in getting people to change their modal choice. If the citizens of Boston do not perceive the public transport system to be safer than driving (though it might be, even in its present condition), they will most probably not use it.

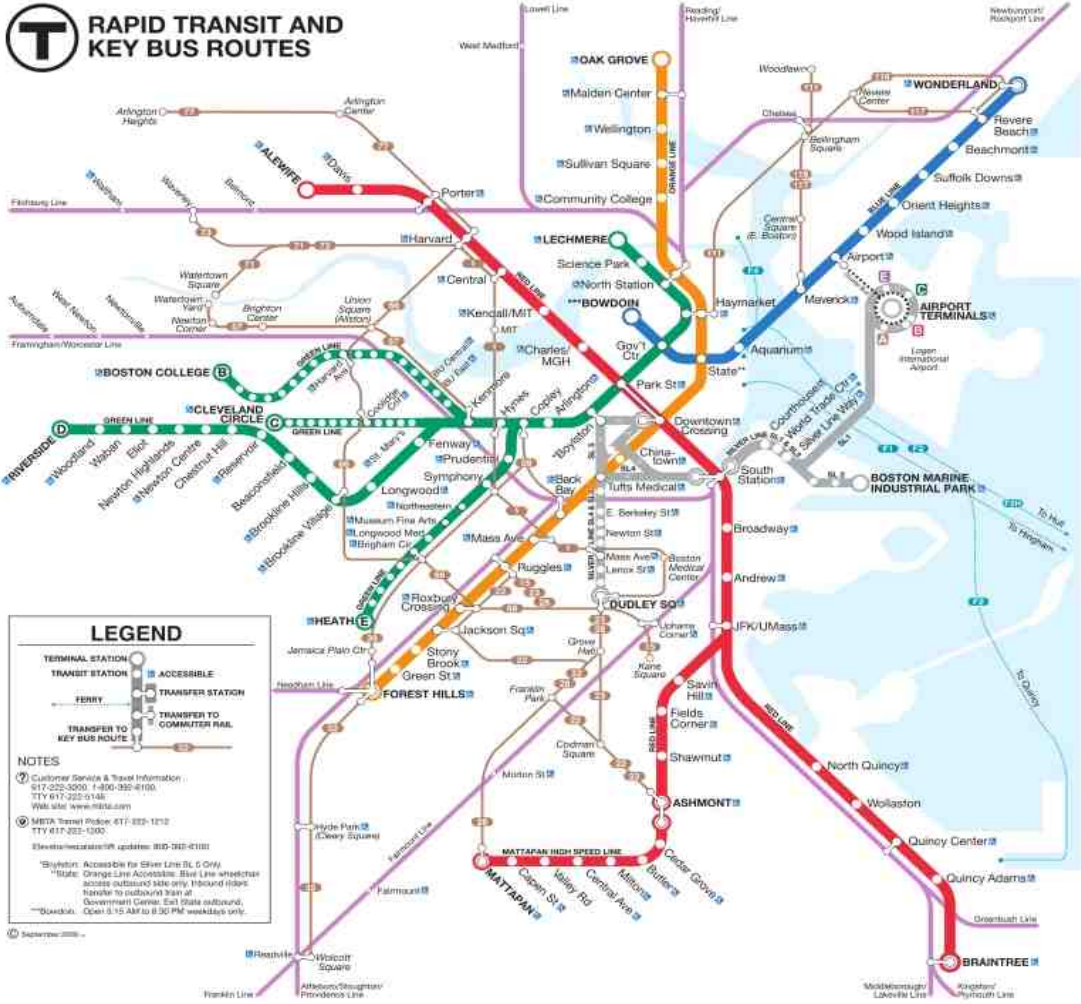


Figure 4 - This map shows the Boston Subway system, as well as the commuter rail system. Note that buses currently operate the Silver Line shown on the map. Some ferry commuter lines and bus lines are shown too. (Massachusetts Bay Transportation Authority, 2010b)

Commuter Rail

The commuter rail in Boston has two major hubs providing service: North and South station. The main issues with the commuter rail are safety and a lack of a connector between the two hubs and speed.

The connector between the North and South stations, or rather the lack thereof, is an obvious flaw in the system. There is no way to travel between the northern suburbs,

directly to the western or southern suburbs without having to change trains and stations in Boston.

Traveling times are also an inhibitory factor. It is currently far faster to drive than it is to take the train for a number of reasons. Schedule conflicts, too many stops on the line, indirect tracks and insufficient safety features to maintain high speeds, are an issue not only for people traveling into the city, but also to those travelling to other towns and cities beyond Boston.

Finally, once again the human factor of the safety issue is a large concern here. The latest incident in Boston saw a driver entering a station too quickly; the resultant crash fortunately causing only minor injuries. Nevertheless the particularly troubling fact is that federal transportation officials state that the MBTA (Massachusetts Bay Transportation Authority) lack a safety culture (Bierman and Abel, 2009). Regardless of whether or not this is true, if the public get this perception of the MBTA, just as with the subway incidents mentioned before, it will render a transition from private cars to public transportation options more difficult to achieve.

Bridge repairs

Jackie Douglas, one of the interviewees for this thesis mentioned that the maintenance of the bridges across the Charles river in Boston are so behind in their planned repair that they all need to be replaced. This fact is something Douglas' organization "LivableStreets" takes advantage of by making the new bridges more accessible to bicyclists and pedestrians.

Renovating all the bridges over the course of only a few years will obviously increase the pressure on the city budget and many, both citizens and officials, are unhappy about this. However, it is one infrastructure investment where bicyclists and pedestrian interest organizations have managed to introduce measures that reduce the space available for cars, showing that it is possible for organizations to influence the development and transition of the city to become more sustainable (Ebbert, 2009).

ANALYSIS AND DISCUSSION

INTERVIEW RESULTS

One of most apparent observations from my interviewees is the lack of plans for the area. The lack of plans is something all interviewees found very frustrating. However, the decision-makers are democratically elected, and the general public can be very conservative and cautious of change. In Cohasset for example, denser development has traditionally been turned down by the selectmen, effectively prohibiting land-use changes. Recently, however, a new by-law was passed allowing for mixed land-use (Brewer, 2010). Kruckemeyer went as far as to state that governments do not worry about the future, they are more worried about re-elections and budgetary constraints (such constraints are rendered even tougher by the recent recession, making the recession a driver to change) (Kruckemeyer, 2010).

Another issue highlighted by all the interviewees is the fact that land-use and transportation are very closely connected. In order to change the transportation habits of the public, the needs for transportation must change as well. Kruckemeyer gave the example of big-box stores now located in areas that are only accessible by car, meaning people must continue to drive there. To eliminate transportation needs, Kruckemeyer suggested that we rethink distribution of goods. One suggestion could be to have smaller concession stores in village centers, which would not carry the entire range of a chain but that would offer the service of ordering an item and having it shipped directly to the customer. Kruckemeyer pointed out that one truck delivering for the whole neighborhood would be preferable to all the people in the neighborhood driving to the store in their individual cars to run errands (Kruckemeyer, 2010). There are many ideas as to how a city or town could be planned to reduce transportation needs; however, all interviewees agreed that denser development and mixed land-use the most appropriate option. This would prevent the creation of residential neighborhoods that are completely deserted during the day and commercial downtown areas that are desolate after business hours. Their views are supported by a study conducted in Toronto, which shows that for every 100 dwellings established in the downtown area, 120 less trips would be taken

each day into the downtown area from the surrounding areas (Nowlan and Stewart, 1991).

OIL PRICE

The interviewees also discussed the drivers of change. They all agreed that there is currently no real incentive for change; however, considering the oil price peak of 2008 which had an enormous effect on public transport ridership and the similar peak seen after Hurricane Katrina in 2005, it is safe to assume that oil prices is a trigger for change. My interviewees had different perspectives on how this change will manifest itself. Rosenblum (2010) argued that suburban areas will lose their attraction and start dwindle, while Kruckemeyer suggested that suburban areas can be re-structured and develop their own nuclei such as those previously enjoyed by many suburban towns (Kruckemeyer, 2010). However, waiting for a rise in oil price to force change is not an option according to Rosenblum (2010). He claimed that permitting gas prices to increase without providing an alternative will create great social injustices in society. This will lead to a migration of those people currently living in rundown downtown areas out to the suburbs as prices there crash and as prices in downtown areas rocket. However, people will still need to travel to work without relying on their cars and consequently Rosenblum fears that when private transportation becomes more expensive, the poorest groups in society will be hit the hardest.

None of my interviewees considers Boston a lost cause; Goldstein (2010) for example thinks that - provided there is progressive governance with decisions makers unconcerned by re-election - Boston can achieve anything in 50 years. In his opinion, there is currently scope for progressive change in the Boston area; it is, however, far from the drastic change that needs to occur. Goldstein argues that the change progressive decision-makers are pushing today simply is not radical enough. A new bike lane is not enough to change how citizens think about transportation.

MODELS FOR CHANGE

As mentioned previously, transition theory describes several stages of a transition, which occur not only in a successful transition, but also in failed transitions. In Boston's case, a failed transition in the transportation sector would mean a continued dependence

on cars for transportation. Therefore it is interesting to investigate, from a theoretical point of view, how this dependence can be avoided.

Change in the Boston Metropolitan area can go in several directions. Loorbach and Rotmans (2006) describe four possible outcomes in transition theory that can be applied on the case of Boston, system breakdown, backlash, technological lock-in and successful transition.

SYSTEM BREAKDOWN

The first and most pessimistic stage is system breakdown. In this scenario, Boston decision-makers fail to respond on time to the challenge of rising oil prices. Kruckemeyer vehemently predicts this scenario, and suggested that governments at the moment are not worried about the distant future but upcoming re-elections. This idea links back to the problem of political myopia as described by Kemp et al (2007) and mentioned above. As the price of oil increases, investments in infrastructure also become more expensive, making it impossible for decision-makers to keep up with the demands of providing alternative means of transportation. People become unable to get to work, and either face losing their jobs, or are forced to make expansive cost-saving adjustments in order to support themselves and their families. As they become more expensive people cannot afford to consume goods and food. The economy becomes crippled, as people cannot travel.

In the case of Cohasset, Brewer (2010) stated that Cohasset is not an early adopter of progressive environmental measures as the town is very conservative. This could mean that should a scenario of system breakdown transpire, this will hit Cohasset hard. Citizens have long distances to both train stations and services (stores, post offices etc) as well as their workplaces. Without an appropriate replacement for the car, people may move from the town to be closer to their workplaces or public transit hubs. This means that, over time, Cohasset will lose tax revenue, and as a consequence may lose the ability to provide sufficient services (schools, police department etc) for its inhabitants, which in turn will drive more people from the town. This will increase real-estate prices in those areas that see a sudden influx of people and decrease real-estate prices in the

abandoned areas. The town's affluence may mean that this process will take longer in Cohasset than in other towns.

There are, of course, short-term winners in this scenario too: especially those people who already live close to their workplaces and towns that offer numerous employment opportunities. However, in the long run, the rising oil prices will eventually make it extremely difficult for all businesses to operate, and no one will escape the long-term effects.

Goldstein (2010) and the Tellus Institute scenarios (The Tellus Institute, 2008) describe this scenario as business as usual: where Boston continues on its current trajectory of development, failing to adapt in time to the rising cost of production and transportation.

BACKLASH

The second scenario discussed by Loorbach and Rotmans (2006) is the backlash scenario. This scenario specifically deals with change that starts well, but fails to reach fruition; a contrast to the system breakdown scenario where nothing changes at all. Geels describes the backlash as a regime that is too stable, so innovations cannot move from the niche level to the regime level (Geels, 2006).

For the Boston area this would mean that, for some reason, the change that has started to happen has not continued. As instances of the backlash scenario in Boston, Goldstein (2010) and Kruckemeyer (2010) offered examples in their interviews of grass roots movements that might be able to achieve some momentum in their work, but are not ultimately successful. Rosenblum (2010) mentioned that small infrastructure changes precede larger changes: for example in the cities of Cambridge and Boston this could be bike racks which increase the biking population or, in the case of Cohasset, a kiss-and-ride² train station.

² A kiss-and-ride train station is a train station that does not have any parking areas. It is usually smaller than a normal train station because of its location, which is typically in the center of towns and cities (Brewer 2010).

Ridership on the MBTA may be increasing and car traffic decreasing, but the current regime is too stable for niche innovations to make a real impact, as described by Geels (Geels, 2006). Reasons for failure to change are numerous; for instance, in the case of Boston, reasons could include lack of biking safety or the poor reliability of the commuter rail service.

These issues alone would not prevent the accomplishment of change, but numerous failed attempts could encourage people to revert back to the business as usual scenario. In theoretical terms, this failed change can be described as a failure of the niche to influence regimes and regimes to influence landscape for a sufficient period to achieve long term change (Geels, 2006). For Boston, this could materialize through a change in majority in the governing body, reduction in the funding of the grass roots movements or a lack of popular support for measures introduced by the current government.

TECHNOLOGICAL LOCK-IN

The third scenario of change is the most relevant for Boston: the technological lock-in. This theme is also discussed by Kemp et al (2007) and was touched on above, and Elzen et al (2004) continues Kemp et al's reasoning with more concrete examples. Boston has a great deal of existing transportation infrastructure. This infrastructure has developed over the past century and a half, and is therefore firmly established. People and companies have grown accustomed to using the existing infrastructure, and while citizens may welcome the occasional new subway line or new road, changing the entire infrastructural system- and thereby causing people to sacrifice some of the comfort they have today - will surely not encourage change. A company that has invested a great deal of time, money and effort in developing a machine that suits their needs is not likely to give that up. The same can be said for cities and people. Cities which have, up until now, focused most of their infrastructure projects on building new roads are not likely to start a project that will make their expensive roads obsolete. The same is true for people who have just bought a brand new SUV; they are not likely to give it up without a fight (Elzen et al., 2004).

In transition theory, the argument is made that as a regime points out the direction of new development, it is a kind of paradigm (Elzen et al., 2004). For Boston, this means

that current development continues. The Tellus Institute's reports label this form of transition as policy change i.e. that policy is changing but is not adjusting as much as is necessary to achieve a sustainable society. For example, if a new subway line is well received some people may slightly alter their travel behavior but will still remain dependent on their cars to get to the subway stop. The main inhibitor for change here is technological lock-in. Technological lock-in makes it hard to make changes with means that are not already a part of the societal system (e.g. radical innovations stemming from the niche level) (Kemp et al., 2007). A Boston example could be construction of a new subway line, which is expensive, but not a problem as it fits in the current paradigm. On the other hand, closing off the entire city to cars, lies outside of the paradigm and will therefore not happen. The same holds true for other technological innovations which do not exist in the present system; the regime will not allow these changes to come through.

Kruckemeyer (2010) took this opportunity to return to his point that if the current situation is not seen as a problem, then the regime is not likely to allow any significant change come about. What we have around us now still works, and does not need to change.

SUCCESSFUL TRANSITION

The last scenario described in transition theory is that of successful change. A successful transition goes through four different stages, pre-development, take-off, acceleration and stabilization (as described in the theory section above). The Tellus Institute's scenarios call this deep change. All interviewees agree that this kind of change is much more likely to happen if the price of oil vastly increases. Kruckemeyer and Goldstein (2010) both went as far as to say that a new crisis is needed in order to push change in this direction. The need for change requires being constant throughout the different stages of change.

For Boston, a sudden jump in gasoline prices could mean the take-off, making some people review their transportation modal choice, perhaps encouraging them to drive less, coordinate their errands better and give the commuter rail a try. A steady increase in gasoline prices would eventually provide the acceleration of change, forcing the

metropolitan area to make adjustments and provide for peoples' needs. Change here will not be unproblematic. Rosenblum (2010) mentioned problems with privatization of roads and growing social inequalities as two examples of the consequence of rising oil prices. These undesired outcomes will need to be addressed or this accelerated change will regress to the backlash scenario. If the consequences of an increase in oil prices are addressed properly, change will stabilize after the landscape level has been altered according to the new regimes and niches (Rotmans et al., 2001).

It is impossible to tell what Boston will look like in 50 years after a transition has happened, but it is safe to say it will be very different. New technologies and social rules will have been put in place, as the landscape level will have changed. The economy may have to be very different from today: with an economy built on services going to people instead of people going to services (as is currently the case with big box stores).

POSITIONING ACTORS

It is difficult to localize actors into a single category, as sometimes fractions of an actor might be located somewhere else, for instance, a very progressive city planner wanting to ban cars might be located in a regime that encourages traveling by car. However, this planner might have radical ideas on how to change the city, and given chance he will, therefore he or she is active both in the niche and in the regime level (or right in between depending on how you see it).

LANDSCAPE LEVEL

The first - and most important influence - located at the landscape level is cultural beliefs (Geels, 2006). These are the beliefs that people base their lives on, for example: what they expect from life, what constitutes freedom and what is quality of life. This could be the inherent value for a person in owning a car: what it means to them personally and what signals it sends to the individual's social group. Having a car in the US is more than just a means of transportation: it could be interpreted as having deep cultural value, and hence may be placed in the landscape level (Geels and Schot, 2007).

On a more tangible note, the current infrastructure in Boston was built some time ago and is extremely hard to reconstruct; highways and train stations are not easily moved. Some of the major concerns in the infrastructure system were listed in the background section above. It takes time to redesign infrastructure. This is an issue that my interviewees are well aware of and try to work around. In spite of this, they recognized the infrastructure is located at the landscape level and that at some point the infrastructure – unless dealt with in a satisfactory manner – will prevent change.

The economic system is also located at the landscape level. The current construction influences the rest of the system to large extent. Many of the decisions taken by decision-makers today - regardless of subject matter - have an economic perspective, whether it is a budget or investments in infrastructure to promote economic growth.

REGIMES

Major companies are located in the regime level. They are positioned here for a number of reasons; foremost they have adapted to and invested in the current infrastructure for transportation and distribution. Using their size, influence and knowledge of the workings of the landscape level; large corporations can influence other actors on this same level by encouraging them to continue development in their desired direction. However, in a regime that is becoming unstable due to the rising price of oil, the risk of a corporation going under is elevated. Kruckemeyer (2010) stated that big-box retailers will need to rethink their future business ideas if they are to continue to be profitable despite rising oil prices. They will no longer be able rely on cheap oil to produce and distribute their goods and to bring customers to their stores.

Another obvious actor in this level is governments (from national to municipal) and decision-makers. Returning to Kruckemeyer's (2010) statement that government's concern is with upcoming re-elections and less with the distant future makes this actor quite unique; governments can be replaced at every election (although some civil servants can remain in service). The potential replacement of a regime every four years can create instability at the regime level, providing scope for innovation. This instability could manifest into alternative politicians becoming elected.

Some interest organizations can also be found at this level i.e. the Metropolitan Area Planning Council (MAPC). With its membership of 101 towns and cities (Metropolitan Area Planning Council, 2010b) it is definitely at the regime level. Bourassa (2010) argued that the MAPC's attempts to pool resources and coordinate planning and development efforts between the towns in the organization, places it firmly within the regime level. The MAPC, consisting of town planners from the metropolitan area, is susceptible to pressure from below by actors in the niche level, which drive the MAPC in the direction that they want it to go. However, it is also under pressure from the landscape level to conform to the current rules and norms.

Another actor at the regime level is the Massachusetts Bay Transportation Authority (MBTA and better known as the T). A public company which owns and operates the subway lines, commuter rail lines and most local bus lines (Massachusetts Bay Transportation Authority, 2010a), MBTA is a big player in the field. Subject to a recent reorganization and merger with other government agencies (such as the Registry of Motor vehicles) it now forms part of the new Massachusetts Department of Transportation (Massachusetts Department of Transportation, 2009b).

NICHES

At the niche level, there are a great deal of innovators and small actors, who influence only regimes and have very little direct impact on the landscape level.

One Bostonian example is the LivableStreets organization. This is an advocacy organization for an alternative transportation system, which was founded by Jeff Rosenblum and is currently directed by Jackie Douglas: both of whom were interviewed for this thesis. The organization's aim is to improve the 'livability' of the streets of Boston, by building partnerships, empowering communities and inspiring a vision (LivableStreets Alliance, 2009b). In his interviews, Douglas (2010) described how the organization works with the community: for instance both by inviting people to their seminar series called "Street Talks" and by actively engaging in the local debate.

The different campaigns currently being run by the LivableStreets Alliance give a great example of direct interaction between the niche and regime levels. In the Charles River Bridge campaign, the organization advocates that as all bridges across the Charles River require renovation in the next few years, the opportunity should be taken to develop more pedestrian and bike friendly bridges. They do this by engaging with other actors in the niche group, such as neighborhood groups which can help mobilize more resources to exert pressure and influence the current regimes (LivableStreets Alliance, 2009a).

The Tellus Institute is another actor at this level. A research organization and host of many different programs, the Institute supports other niche actors (for instance towns) in their transition work (The Tellus Institute, 2009), providing another good example of how niche actors can collaborate in attempts to replace or change the current regime. However, it is not uncommon for the Tellus Institute to receive a government assignment, which moves it up to the regime level from the niche level and gives another example of the ability of actors in some instances to move between the niche level and the regime level.

Small businesses are important actors on this level. Many of my interviewees talk about a densification of land-use as an inevitable consequence of the change needed to take place. This creates the opportunity for new and existing small businesses to gain back some of the custom lost to big-box stores in the recent years (Haltiwanger et al., 2010). Small businesses established closer to residential areas will have an impact on the regime in the sense that town planning will have to take small business into account since development of these small business is required to reduce and change the need for transportation. The first step, however, needs to be taken by towns and cities because otherwise no business can establish itself in a residential area. As mentioned previously Kruckemeyer (2010) suggested that these “small businesses” could be a large corporation using a small storefront to display some of their merchandise, then offering to ship a wider selection of goods to the customer’s homes.

At this level individual innovators and entrepreneurs also play a big part. Bourassa (2010) offered the example of introducing a bike-share program in the city or the

experimental development of an apartment building in an area dominated by single-family houses.

Grass roots environmental societies (such as Sustainable Cohasset) also play an important role, not only because they aim to influence actors at the regime level, but also because they have the ability to involve other, previously excluded, organizations in their work, which Kruckemeyer (2010) said is in a contrast to the 1968 during the anti-highway movement. In that period all manner of organizations were involved in the movement: from environmental organizations to the civil rights movement. These actors have the potential of moving up to the regime level if they receive proper funding and are accepted at the regime level by other actors, for example by providing advice for a local government. However, it must be recognized that the moment an actor moves from the niche level to the regime, they also become more susceptible to pressure from the landscape level. In practice this could mean that a group becomes less radical as they seek further legitimacy under the terms of the landscape level.

It is important to consider potential for interaction between actors in order to understand the extent to which change can be accomplished, not only between levels in the model, but also between actors at the same level. This is important not only to the researcher, but also to the people working in the organizations, so they know where to focus their efforts to make the highest impact and to whom they could collaborate to achieve a higher success rate in their work.

TRANSITION MANAGEMENT SUGGESTIONS

Based on data from my interviewees and the analysis of this data, there are some issues that should be further consider to establish their possible role in a transition to a more sustainable transportation network.

DEVELOPMENT PLANS

The absence of plans is the first issue that should be addressed; this is both an advantage and disadvantage for Boston. On the positive side new plans can be created without deference to completion of previous or current plans. This offers an opportunity for

different stakeholders to provide their own suggestions for plans or visions, and this has been done in many cases; the Tellus Institutes, for example, have their own Boston specific scenarios; the MAPC produce their visions for the future at MetroFuture.org. However, it must be acknowledged that while stakeholders can suggest examples, there is nothing to suggest decision-makers will adopt them. Brewer (2010) stated in his interview that despite Cohasset having a master plan for most of its development issues, it is lacking in the transportation and mobility section. Cohasset is not alone in this case; Rosenblum (2010) described how the City of Cambridge also lacks long-term plans although the reasons for the deficiency in plans are different for both places (conservatism in Cohasset and budget constraints in Cambridge).

Adopting a long-term plan for a transition to a sustainable transportation network should be prioritized. This is required to point Boston in the direction of development. However, a plan that is developed from only one perspective may not prove very successful and may fail to obtain a good approval rate. Decision-makers in the Boston area could bring planning to a grass roots level, to bring in local citizens and businesses in the discussions of what the communities need. This would be an excellent continuation of the work that MAPC is already doing by bringing together planners from 101 cities and towns. This work would go even deeper by engaging further with the neighborhood sports clubs, book clubs and retail associations, thus increasing the interaction between the regimes and niches, and in the end influence the landscape level in the desired direction. According to Geels and Schot, transition happens only when there is interaction between all three levels (Geels and Schot, 2007).

However, one issue decision-makers cannot ignore is the proposed form that this transition of the transportation system should take. Should it take an evolutionary approach or a more goal-oriented focus (i.e. concentrating on where we want to be, how to get there?). From the point of view of transition theory, both ways are feasible (Loorbach and Rotmans, 2006). For Boston a goal-oriented transition would appear to be most beneficial as it a universal goal to work towards. However, as it is impossible to predict future innovations and politics developments over the next 50 years - some of which could be of great help for Boston's decision-makers - the goal should not be

chosen unless it offers a degree of flexibility. Therefore, a combination of both evolutionary and goal-orientated methods is suggested for Boston decision-makers.

The difficulty is how to convince the decision-makers to take a path that has not been traveled before, especially when there is no guarantee that a specific project will be successful. In their book Elzen et al point out that no government is omniscient and consequently cannot predict every obstacle along the road to transition (Elzen et al., 2004). This inability to predict the future is obviously not unique to decision-makers, however should a project fail, actors at other levels may be less reluctant to try new ideas because they may not face the same consequences as an elected government official. Confounding the problem is the fact that it is highly improbable that anyone could identify a single set of technologies suitable to achieve the transition (Berkhout, 2002). In short, it must be acknowledged that there will be a lot of trial and error in the future; some technologies and niches will be successful, others will not.

The lack of plans is a typical example of political myopia that is described Kemp et al (2001). There is no focus on long-term development of the transit system in Boston and decision-makers cannot even agree on the nature of the problem, linking to the dissent problem mentioned earlier in this paper.

OIL

The price of oil was mentioned by several of my interviewees as both a trigger and driver for change. For instance, Bourassa (2010) stated that a clear spike in the ridership on the MBTA trains and buses can be seen during the 2008 price peak and immediately following Hurricane Katrina. Clearly, people will reconsider their transportation alternatives when the price of transportation increases. This might mean that all Boston has to do for people to switch from their current transportation modes to a more sustainable one is to wait for oil prices to go up.

There are obviously numerous problems connected to this: not only practical in terms of an overflowing public transport system, but also in relation to social injustices (as

Rosenblum (2010) pointed out), where people cannot get to work, and businesses fail because they cannot transport their workforce or goods. Therefore heavy emphasis needs to be put on investigating who will be hit the hardest by rising oil prices and how the economic pressures on those who are worst off be alleviated, while at the same time keeping the pressure constant on those who can afford a more sustainable mode of transportation. It is difficult to get a head start on mitigating the effects of rising oil prices, when we are not sure what the effects are.

Atash (1996) notes in his article that there are many issues caused by urban sprawl, including long commutes and no sense of community in the suburbs. It has also added to the problem of downtown areas becoming more undesirable to live in, which encourages more people to move to the suburbs. This creates social problems, which make the city centre even more undesirable to live in, and thus encouraging even more people move out, creating a vicious circle migration. However, an increase in oil prices will see the cycle reverse: the proximity to commercial areas making downtown areas the ideal place to live. This will push up prices, forcing the less well off into the suburbs where public transportation is not readily available.

Rosenblum (2010) is correct in his assumption that these and further issues of a more social nature (i.e. income disparities and equality between neighborhoods) will need to be addressed in order to come to terms with a transition that is beneficial for all, and not just for a number of lucky people. How to do this is a topic for another thesis, however its importance cannot be underemphasized as history has shown us that social problems are a threat to development of a sustainable transportation network, unless resolved in a satisfactory way (Brown et al., 2009).

Introducing a tax on oil and letting the surplus finance a restructuring of the transportation system is another option raised by Brewer (2010). This could give the government more control over the rising cost of fuel, and at the same time, finance some of the necessary transport changes. If successful, this change could trickle down to the niche level, encouraging more people to change their modal choice in transportation while at the same time allowing some flexibility for the government should oil prices

suddenly skyrocket. This will however, only work if the tax income is used to invest in public transportation infrastructure and not in measures designed to allow new cars on the road, such as building new roads. This type of financing has worked in the past when building freeways (Brown et al., 2009), therefore - if the political will is present - there is no reason why this type of financing could not succeed, at least in the short term until demand in oil decreases naturally. However, it must be acknowledged that, in the political climate of today, this kind of fundraising is not feasible as raising the price of oil would effectively be political suicide.

Another issue, connected not only to the levying of taxes but also to the explanation of the true cost of transportation in general, is that those who present the figures are usually perceived as those responsible for increased costs. An experimental study in the Netherlands showed that when researchers calculated the actual price of driving a personal car and presented their findings to the drivers, they were perceived as responsible for the costs. This increased the psychological resistance to changing modes of transportation, and should be kept in mind when working on these issues in Boston (Tertoolen et al., 1998).

The issues of oil are also tied to lock-in. We have a socio-technical landscape today, which is almost entirely based on oil. We are programmed to build on this old habit of a supply of cheap energy when designing and adopting solutions and hence we face the problem of lock-in that Kemp et al (2001) highlight: we select a technology too early in the process. This technology might not solve the problem in the long run, for instance, hydrogen cars could be considered an example of where we have replaced fossil fuels, but still continue our previous lifestyle.

LAND USE

One way to reduce the previously discussed social problems that may be caused by a massive migration from the suburbs to the inner core of the city is to change how the land is used. In the example of Cohasset above, Brewer (2010) mentioned densifying the center of the village by building more apartment buildings, but also allowing commercial interests to blend with the residential areas to a much larger extent than it is

now. This would benefit residents living in the town by reducing their needed driving and time spent traveling.

Most of the people interviewed for this thesis kept coming back to the problem of land use on all levels. Land use is mostly an issue for the suburban parts of the metropolitan area since the cities contain most of the city services already (shops, schools etcetera) and it might be difficult to increase the density of these areas. In Cohasset, Brewer sees a need to allow commercial interests to enter the town and mix with residential areas to allow residents to run all their errands without having to drive, at least not for long distances (Brewer, 2010). In order to facilitate this change Cohasset decision-makers need to encourage the building of new residential buildings in the commercial town center, but also allow commercial development in the outskirts of the town in traditionally residential areas. Apartment buildings that are both attractive and affordable need to be built closer to public transportation.

Nevertheless, changing the zoning to allow mixed use of the land is neither easy nor the only thing that needs to be done. First of all, it is necessary to assess where it is most viable to re-zone land. Rodriguez and Joo state that there are many factors that are normally not considered, but which need to be taken into account in order to encourage people to change their modal choice:.. such as the natural gradient of the land (i.e. people might be reluctant to bike to a hilly place) and the availability of sidewalks (i.e. it might not be safe to walk in the road) or the scenery (Rodriguez and Joo, 2004). Having a mixed-use area that no one can access, does not serve any purpose; the reasoning behind a mixed-use area being to allow people to reduce their motor vehicular needs.

In the city - as densifying areas might be problematic - other areas of concern need to be addressed, i.e. reducing the number of cars in the area. There are many different ways of planning a city to reduce the number of necessary car trips; for example development can be public transit oriented. Usually, a mixture of planning approaches is used to reach the desired goal. The challenge for planners in already dense cities such as Boston, Cambridge and Somerville is to figure out what models will work for their neighborhoods, A universal approach may not suit each individual place and so the

solution will have to be tailor-made for each location. Another very important realization is that many of the trips taken today have never been undertaken by public transport at all, and are therefore extremely averse to a modal shift (Marshall, 2000).

This is yet another area where the grass roots movement on a niche level could be involved to assist planners in assessing what the exact needs are in every area concerned, and what the conditions are required to accomplish change. A dialogue needs to be entered into between regime level actors and niches actors. Niche actors should also be given the opportunity to display their transportation innovations that could be adopted in the area to ease the transition.

It is impossible to know what the cities and town in the area will look like in 50 years and most of my interviewees agreed that we have not seen the last of personal cars yet. That said, a change in how land is used will bring significant differences to the people living there and diminishing the need for cars seems to be one of the biggest concerns of my interviewees. Although a widespread transition is not currently occurring there are some localized initiatives taking place. Bourassa (2010) gave the example of an IKEA establishment in the city of Somerville, where residents were very concerned that a new commercial concern in the middle of a residential area would bring a substantial increase in car traffic. However, IKEA agreed to finance a new subway station servicing the surrounding area, with at least one entrance facing away from IKEA to the residential neighborhood. It also offer discounted shipping to the customers coming by public transport so people would not have to face dragging a heavy couch home on the subway. This is an interesting example of how regime and landscape actors can also become innovators at the niche level. These actors will also have the benefit of being able to directly influence others by setting an example for other companies to drive the landscape level in a more sustainable direction.

Changing land use is difficult not least in relation to the decision of what short-term steps need to be taken to accomplish a long-term transition. Kemp et al (2001) argue that change in land use must happen or stakeholders can lose interest in the transition.

ALTERNATIVE BUSINESS DEVELOPMENT PATH

As previously mentioned in this thesis, in view of the fact that they have invested a great deal of time and money in the current infrastructure, businesses tend to be conservative; hence major companies are located in the landscape segment of the transition model. Companies are dependent both on having goods transported to their location, as well as customers being able to travel to their stores. With the rising oil prices, companies will face some tough choices and restructuring problems, and this will influence what the cities and towns look like.

According to my interviewees perception of this problem, especially Kruckemeyer's (2010), the end of big box stores will come to an end when it is no longer viable for big-box stores such as Wal-Mart to ship cheap manufactured goods from China to the US. Wal-Mart and Target are two major US chains, which have seen their customers, hit hard by the current economy and so are already rethinking their concepts. They are looking to reduce store size, and move into urban neighborhoods instead of suburban commercial centers, and are changing their concept to be more like a neighborhood convenience store than a big discount retailer (Maestri, 2010). It is clear that the company's restructurings are profit driven, however, this change can be viewed, through the framework of transition theory, in two different ways. As these stores are quite innovative and -for the moment at least - quite alone in introducing this concept, it can be seen as a landscape actor going down on its own initiative to the niche level. On the other hand it can also be seen as an example of the niche and regime level actors pressuring actors in the landscape level to change their practices. In this particular example, it might not be out of free choice that consumers influence the regime, but because they are running out of options. The consumer on the niche level cannot continue travelling to big-box stores to shop. This will pressure the actors on the regime level to consider ways to provide consumers with what they want even though they cannot afford to drive to the stores. For instance, were the MAPC to rethink their plans and allow commercial interests in neighborhood areas this could turn will slowly influence other actors at the regime level.

Stores adapting to meet their customers' needs is one factor, however, there is still an issue for companies with commutes for their workforce to the office every day. This is a topic that the interviewees did not much touch upon, however, Brewer (2010) stated that he sees a correlation between the geographic location (in this case Cohasset) and the amount of people working from home or in their immediate area. Brewer stated that Cohasset is located in an awkward location from a commuter perspective. There are no major roads connecting the town to Boston, and up until very recently there was no public transport whatsoever. This has encouraged more people to work from home in Cohasset when compared to the surrounding areas.

This is a positive example of how attitudes in the landscape level can trickle down to the niche level and influence the travel patterns of the individual actors working at this level. This also shows that the mechanisms are in place for a future transition. If Wal-Mart can move to reach their customers, they can also move to reach their workforce, and the same can be said for every major company. One ancillary benefit we might see is that cities and towns will become livelier as downtown financial areas will no longer be deserted after 6 pm on weeknights,

CONSERVATISM

Brewer (2010) raised the issue of conservatism in his interview by stating that the people in Cohasset are very conservative and that the town is not an early adopter of innovations (for instance, it took time before the citizens would accept the railroad being built). This raises the question of how people in Cohasset can be influenced to change their ways? The people living in the town are a part of a collective, which belongs in the landscape level. As noted above, they share the same deep-set cultural values which makes it difficult to influence them as a group (Geels and Schot, 2007). However, interestingly, individuals are not in the landscape level, but form part of the niche level. This means that people can form grass-roots organizations, (not limited to environmental interests, but also centered on cultural and sports for example). Not only can these people influence regimes through their work that will in turn over time influence the landscape level (for instance the local town government, but they can also pressure each other into becoming more progressive. If an environmental organization

can influence enough people to vote for a different government, the regime can change. Therefore if they can influence enough people to shop downtown instead of at the local big-box stores and the regime of companies in the area can alter too. If the regime is subjected to enough pressure, it becomes unstable and opens up to change. This is a process that could be used to counteract the conservatism currently prohibiting change in places like Cohasset. This is consistent with Rotmans et al's reasoning that early in transitions, current regimes are resistant to change and often try to fight it. Therefore regimes must be influenced in such a way as to encourage government to take a lead in the transition, instead of opposing it. According to Rotmans, this can be a long process and the work of the niche groups might be bound in the transition for an extended period, perhaps even decades (Rotmans et al., 2001). Therefore, it is important for the progressive groups in Cohasset to organize themselves and start this process.

In dealing with these issues, it is necessary to remember that local governments are much easier to influence than national or state governments, as they are closer to the people (Rotmans et al., 2001). The LivableStreets Alliance would be wise to keep this in mind when working on their different projects. Should they manage to influence the local governments, chances are that other local governments will follow suit and also try and replicate some of the changes the Boston government has tried.

Another important factor to keep in mind when dealing with conservatism (mentioned by Rotmans et al, and touched upon above) is the fact that it takes time for people to familiarize themselves with new technology and new options. People might like an idea and even form user groups to promote it, however, as long as the regime remains stable no change will come about on the regime level, and consequently a great deal of innovations will get stuck in the niche level (Rotmans et al., 2001). This can be seen in Cohasset in relation to the commuter rail, which people do like, however, the usage will not take off until the regime changes and creates incentives for the inhabitants to use the railroad or allows a train stop in the middle of the town. This could happen if the regime is exposed to pressure from the landscape level by rising oil prices for example.

THE ROLE OF TECHNOLOGY

While technological lock-in was touched upon as a barrier to transition earlier in the thesis, the positive role of technology is an important one to address. All interviewees agree that technology plays a significant part in Boston's transition, that said, it has been made clear that influencing people and businesses' behaviors play an equally- if not more- important part in transforming Boston's public transport system. Nevertheless improving our current technology is not an insignificant factor in a transition.

Technological add-ons and hybridization are two important concepts for several reasons. Over and above those technological innovations in the niche level, they tend to be favored by governments operating in the current regime, which make them easier to implement. Secondly, as they form part of the current landscape, people will find it easier to adopt the new technologies (Köhler et al., 2009). This will be especially beneficial in the preliminary stages of a transition, when people and businesses must adapt to new concepts.

Technological add-on and hybridization occurs when new technology "hooks on" to existing technology, not changing it to an extreme degree. Creating a new technology on the niche level that is an add-on or hybridization to an existing technology allows the innovation to be accepted into the regime and hence used and accepted by everyone. This will create what Elzen et al call a symbiosis between old and new technology at an early stage in the transition (Elzen et al., 2004). Rotmans et al also agree with this description, adding that once new technology has been established in the regime, the regime can act as a catalyst, adding important financial capital and know-how which spread a new innovation further (Rotmans et al., 2001). In Boston this could be some kind of new subway train, electrical buses or perhaps a new traffic flow system.

Rotmans et al (2001) make yet another important observation that, while technological innovation is important, we already have access to good technology which is currently in use such as the bicycle or the electric tram (Rotmans et al., 2001). This is a very important point; there is always a risk that decision-makers see new technology as a gamble and so avoid implementing it (this has also been touched upon earlier in this

paper). A transition may be made more appealing to decision-makers by focusing on current technologies, since which have to be found to be stable and reliable.

Therefore, while technology certainly plays an important role in the transition to more sustainable modes of transportation, it does not necessarily have to be new technology. In the case of Boston, this fact was highlighted when the interviewees talked about both implementing new technology and changing people's behavior.

THE ROLE OF GOVERNMENT

The Government has the responsibility to figure out what direction development should progress: a tough role in all areas, not only in relation to transportation. During this thesis, two polarized ways of thinking about transportation have presented themselves; reducing the need to travel or increasing the possibility of travel. Litman states that in order to really change the transportation system, we have to change our way of thinking from 'more is better' to 'more is less' or in other words that accessibility to most services should increase by moving them to closer to the people in order to reduce the requirement for travel (Litman, 2003).

Most of the interviewees agreed with Litman. However, in the current landscape level, there still exists a pattern of increasing mobility, as the regimes want people to be as mobile as possible. Should the government try and reduce the mobility of people, this will present a major challenge because people may feel that the government is trespassing on their freedom, thus a restriction on people's freedom to move may not be possible, at least not right now. Measures should be taken to promote less travel in general (especially commuters and especially by car). However, if the price of oil should increase this could encourage people to choose alternative travel methods without the intervention of a government.

O'Fallon et al conducted a study based on a number of different scenarios in which the government had implemented projects to reduce the number of cars in a city, in order to establish what measures would work best to influence commuter behavior. Their conclusion was that there is no universal solution for each of the scenarios: instead each

city should investigate the most appropriate measures based on context (O'Fallon et al., 2004). The same is true for Boston. While ideas can be borrowed from other places, decision-makers will have to consider what will work best in Boston as a concept cannot be directly copied from a European city for example, because there are so many differences.

Leisure travel is something that is usually not spoken about much when it comes to changing people's behavior, and the interviewees for this thesis were no exception with emphasis being placed mostly on work-related travel. However, leisure travel poses as much - if not more so - of a challenge than work-related trips.

In his study, Ibrahim notes that usually when studies relate to mobility, they focus on commuters. In his study, Ibrahim concentrates on shoppers using public transport in Singapore to establish their needs. Not unsurprisingly, his conclusions are slightly different than that which would be expected from a study on work commuters, for instance the shoppers' emphasis lays on comfort rather than efficiency and perception of public transportation considerably influences their decision. (Ibrahim, 2003). This is a very important consideration for Boston as well; upon studying the plan of the public transit system in the Boston area, it becomes apparent that all transit lines start in the periphery and move towards the center, which is convenient for people working in the center, (as most people tend to do). However, many leisure activities take place closer to home and often it is necessary to travel by car there. People today in Cohasset cannot go to the gym, the movie theatre or the grocery store without using personal transportation. It is also difficult to travel from one suburb to another, on public transport, without going via the center. For instance, using an example from my own experience, a trip from Cohasset to Framingham, which is just under an hour away by car, would take at least two hours using public transportation because you would have to travel via Boston.

Decision-makers in Boston must focus their efforts on the area of leisure travel, as this is an area that so far has been largely left untouched. This is a much more difficult area of concern to address, as it is trickier to chart leisure movements than charting journeys

to and from work, because leisure travel is irregular in the sense that people do not commute to their leisure activities as they would do to work.

Kemp et al (2001) also discuss the issue of distributed control in relation to Cohasset. In a system where towns and cities are more or less independent, it is difficult to coordinate efforts to move towards a transition. In Boston some efforts have been made to rectify this situation through the MAPC, however, such collaboration is fragile and a change in government in a number of the cities connected to the MAPC could have consequences.

MEASURING CHANGE

One final important consideration is how to measure success. Without measurements to support claims of failure or success, it is difficult for change to progress in a managed manner. Litman suggests that there are three different ways of measuring success; traffic, mobility and accessibility (Litman, 2003).

Measuring traffic can be equated to the number of cars in the streets or the number of buses or passengers. This is a fairly straightforward approach, which is easy to measure. This measure is useful when assuming that increased vehicle mileage is a good thing for society. From a mobility point of view, the assumption is that if travel mileage or speed increases, this will benefit society as whole. This measure recognizes that some people do not use motorized transport for any reason; however, the emphasis is still on cars and trucks. Finally, if measuring with accessibility in mind people need access to their required services, goods, and activities. (Litman, 2003).

It is important to realize that each of these measurements is useful. In painting their picture of the ideal society, my interviewees would ultimately emphasize accessibility as a measure for a good transport system but this should not be done until transition has been completed in Boston. At the moment, emphasis seems to lie on the first measurement, where absolute numbers mean the most, but no attention is paid to any potential lack of access to services. It is therefore suggested that during a transition

period decision-makers and others try at least consider the other measurements recognizing that they all complement each.

Litman's measurements are not the only indicators that can and should be used to measure success. However, they do provide a very good overview of the location and nature of the problems.

It is also important to keep in mind that change is a cumulative process. Berkhout stated that change is coming, the main difficulty is trying to figure out when it is coming. The change from horse and carriage to motorized cars did not happen overnight, but was a cumulative process of several innovations, shaken regimes and alliances that made the motorized car a success. (Berkhout, 2002). The same is true for a transition to a more sustainable transportation system. The people of Boston will not wake up one morning and see that a new system is in place. It will take time, but eventually it will exist. Elzen et al talk about different phases of transition and of how technologies wait in the niche level until the right moment to break into the regime level and eventually out-compete the current regime (Elzen et al., 2004).

CONCLUSIONS

This thesis analyzed what the major challenges are for Boston to transition to a more sustainable transportation network. Data was collected through a mixed methods approach, using qualitative interviews and a literature review. A short background of current and past challenges in the infrastructure of Boston is provided for the reader as a backdrop of the challenges faced by interest organizations and planners.

Using transition theory, the data collected in the interviews was analyzed and the actors mapped in a multi-level approach. Throughout the analysis section, individual issues revealed were listed and analyzed together with suggested actions to improve the situation in Boston.

Judging from the data collected for this thesis, Boston does have many of the prerequisites in place for change to take place (such as grass roots organizations and collaboration between different organizations) and thus it presents an interesting case study. There are issues that need to be addressed in order for Boston to complete a transition in the transportation sector. Below are some of the main conclusions and recommendations of this paper, followed by suggestions for future research, i.e. issues that are important to a transition, but were outside the scope of this thesis.

- Collaboration – There needs to be more collaboration between different interest groups, and not only between the environmental groups, but also between neighborhood associations, historical societies or civil rights movements. A transition in the transportation sector will affect everyone and hence should be of interest to all. This I, in my opinion, where a transition should start. A grass roots organization pushing against the regime might make in unstable enough to actually let innovation into the regime level.
- Rising cost of oil – Throughout the interviews conducted for this thesis, it was noted that decision-makers in Boston are not prepared for if and when oil prices rise. Should prices increase in very rapidly, the elevated cost of transportation

would create a big challenge for Boston to overcome. This needs to be addressed ahead of time, perhaps by a price mechanism, which gives the government greater control over the price of oil, such as a tax. Not only would this allow the government to ease the price increases, it would also create revenue necessary to invest in sustainable transportation. However, to attempt to do so today would be political suicide, which is why it is important that grass roots organizations, with the support of citizens, also try to push through these changes.

- Evaluation is important – It is essential to know what is working and what is not. There are number of different evaluation techniques, and one way might not be good enough, however actors need to be pro-active to figure out how to move the transition forward.
- Make plans – There are currently no plans of what Boston wants to achieve in the next 50 years. Boston has great potential, however somebody needs to take the initiative and start making plans, by back-casting to start a goal-oriented transition. This is probably the most difficult point as decision-makers will need to look beyond the short-term benefits of maintaining the status quo.
- Holistic picture – Throughout this thesis it has become apparent that transportation is related to many different parts of a society; it is not only a way of travelling to and from work, but also a means to ensure food on the table and to make secure a desired vacation. As a result of this interrelation and the changes that will come about when the transportation system adapts, a holistic approach is necessary to make sure all sections of society are involved in the process.

SUGGESTIONS FOR FUTURE RESEARCH

- How to deal with social problems arising from the transition – As previously stated in the thesis, changing transportation patterns might cause social issues as the poor are forced to move or are unable to transport themselves. Preventive measures need to be taken, however little research exists in this area today.
- What impact will a rising oil price have on Boston? – What will Boston look like if gasoline prices rise and nothing is done? The Tellus Institute has provided their scenarios, however deeper research with focus on oil prices is necessary.

Such a study would need to be tailored for Boston as conclusions could not be drawn from generalized studies as every city or place is unique and consequently will suffer from different impacts from the increasing cost of transportation.

- How can a network of differentiated grass-roots organizations be created – It has already been mentioned that there is not a network for grass-roots organizations uniting for a common cause at the present time. A larger number of organizations acting for the same cause would most probably benefit the transition in Boston, however how this network should operate needs to be researched.

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APPENDIX – BIOGRAPHIES

The purpose of this section is to provide a short presentation of each of my interviewees. They are listed in alphabetical order (based on last names).

- Eric Bourassa – Works for the MAPC where he is the manager for MAPC’s transportation division. He is also the vice-chair on the Metropolitan Planning Organization, which is responsible for the development of transportation plans in the area.
- Clark Brewer – Brewer is an architect working for the planning board in the town of Cohasset. He has been on the planning board for a few years, but involved in town planning for the past decade. Through his work in Cohasset, he is also connected to the MAPC. (From interview).
- Jackie Douglas – Is the director of the LivableStreets organization. Has a long background in other advocacy organization and knows a great deal about public policy. Graduated from Boston University where she studied the forces that make people who they are. (<http://livablestreets.info/people>)
- James Goldstein – Goldstein is the director of the Sustainable Communities Program at the Tellus Institute. He has 20 years of experience in evaluating and analyzing environmental problems and is one of the authors behind the Boston sustainability scenarios (<http://www.tellus.org/about/Goldstein.html>).
- Kenneth Kruckemeyer – Kruckemeyer is a research associate at the Center for Transportation and lecturer at MIT. He has a background in the Department of public works in Massachusetts and was also the project director for the expansion of the Southwest rail corridor in Massachusetts. (www.hsph.harvard.edu/healthdesign/pkg-pdf/bios.pdf)
- Jeffrey Rosenblum – Is the co-founder of LivableStreets. Works right now as a city planner in the city of Cambridge. Has 15 years of experience in public advocacy organizations and has also worked on sustainability projects abroad. Rosenblum was also a member of the Tellus Institute. (<http://livablestreets.info/people>)