NEMODE/SSN+ PLACEMENT REPORT

Exploring Future Cityscape Models through Urban Logistics Prototyping

Abstract

This report presents the results of field research conducted as part of a NEMODE/SSN+ funded placement to the Centre for Transport and Logistics (CTL), which is based at the Massachusetts Institute of Technology (MIT). The Boston visit took place between May to August 2013. In addition to developing an understanding of the scholarly philosophy and working practices of academics at MIT, a research investigation (based on urban logistics prototyping) was also undertaken in Cambridge and downtown Boston. This report presents the key findings of my work into future cities, technologies, products and new economic models. These prototypes blended together logistics theory and qualitative research (in depth interviews, focus groups, workshops) with fictional imaginative constructs. In addition, several interviews explored executive perspectives on new economic models, the digital divide and user-driven modes of engagement. The underlying aim of my research project was not to provide definitive plans for cities, products or technologies. Rather the placement sought to develop some strategic insight into the visions, hopes and fears that everyday citizens (as well as executives and leading scholars) have towards the human and social impact of digital transformation. The report is structured as follows:

Section 1.0	Introduction
Section 2.0	Literature review
Section 3.0	Prototyping/theoretical advancement
Section 4.0	Results
Section 5.0	Conclusions (followed by references and Appendix 2: diary of research activity).

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The construction of a prototype investigation is both a complex and challenging activity. This is clearly an emerging methodology which is not yet established. However it potentially allowed the researcher to move out of the lab into the wild, and through a discovery-based approach, develop greater knowledge and understanding of the key societal and human issues relating to future cities and new economic models.

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1.0 Introduction

This investigation aimed to explore using the "prototyping" research method, the influence of four macro logistic trends (densification, virtualization of sales and products and decentralization), on the planning of future cities, new economic models, products and technologies. During my three-month placement (May-August, 2013) at MIT's Centre for Transport and Logistics (CTL), in-depth interviewing, workshops and focus groups were conducted as part of the prototyping development process. Appendix 1 presents a summary of the key research activity. This report is structured in conjunction with the categories presented in Figure 1. *Theoretical advancement* is the focus of Section 2; *scenario context* is the main theme of Section 3; *scenario development* provides the focus for Section 4 *while data convergence/results synthesis* provides the guiding theme for Section 5 and finally the *conclusions, limitations and future strategy* are presented in Section 6.

2.0 Literature review: urban logistic prototyping/theoretical advancement

MIT Media Lab's Marvin Minsky, is an expert in artificial intelligence who also writes science fiction (SF). He says that: "*a couple of hundred years from now, maybe [the science fiction writers] Isaac Asimov and Fred Pohl will be considered the important philosophers of the twentieth century, and the professional philosophers and management theorists (futurists) will almost all be forgotten, because they're just shallow and wrong, and their ideas aren't very powerful [1]."* Minsky credits Robert Heinlein's SF for his interest in artificial intelligence (AI): "… *and if we had all read the books by [the science fiction writer John Brunner more carefully*," Minsky says, "*we would have had screens in our eyeglasses*" in the 1980s.

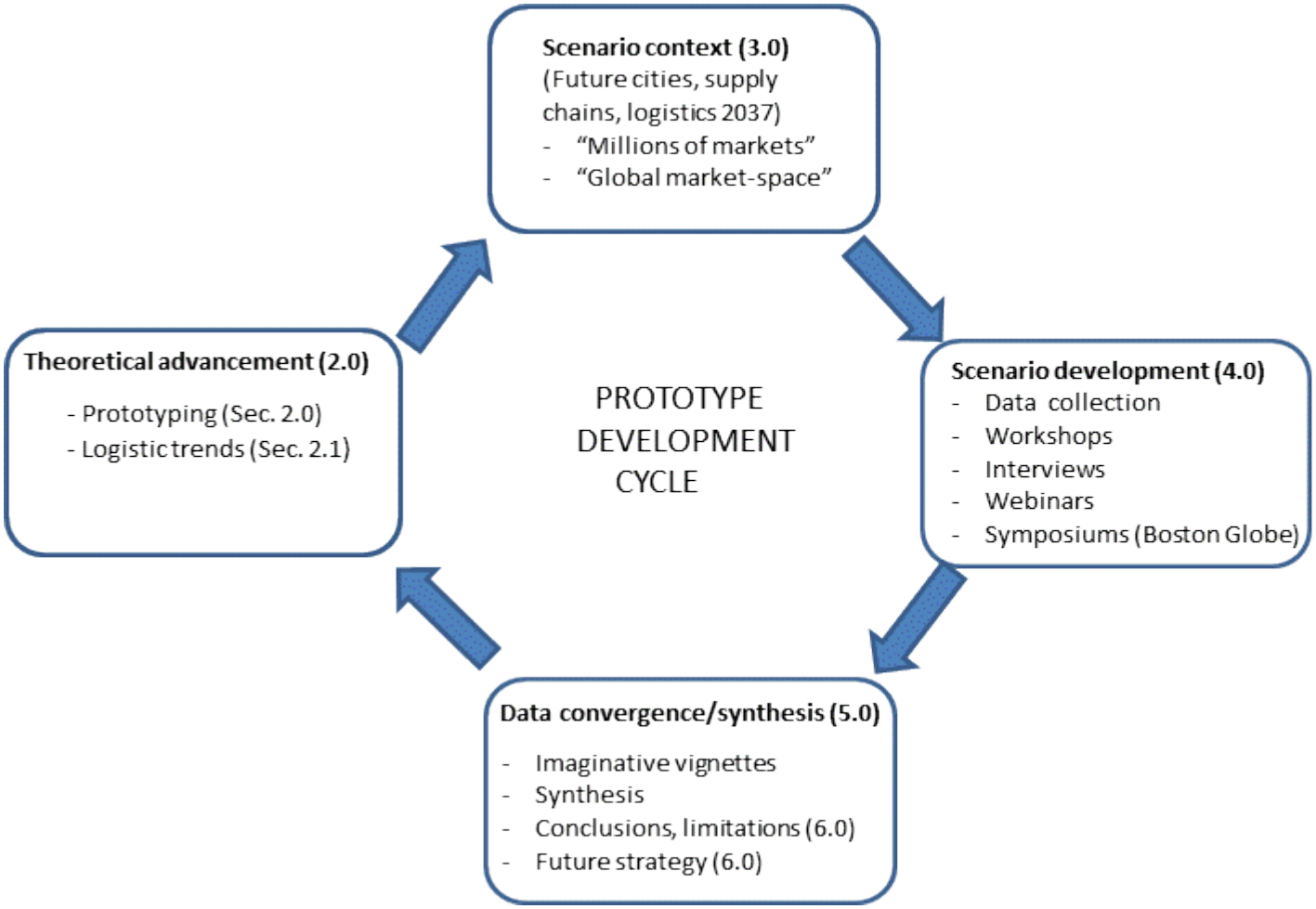

Figure 1 The prototype development process

He says the movie *2001* introduced him to the idea that a computer might eventually be able lip read: "*I have spent years trying to devise computer lip-reading systems*." The thought experiments of speculative fiction may even help us face whatever real futures await us, says Minsky [2].

Johnson [3] explains that: "*science fiction stories, movies and comics have been created for over 100 years based on science and technology facts*". However, prototypes differ from SF stories in that they utilize fictional creations to imagine the human and societal implications of future technology. They also enable everyone in a city community to have a "voice" and a say in their future. According to Egerton et al., [4], fictional prototypes can be used as design tools in the development of technology to provide a virtual reality in which a technology can be explored and, most importantly, a new (human) perspective on the technology itself developed. They can also catalyze an upsurge in creativity encouraging new paths to be discovered and experimental possibilities to become apparent in a fictional setting that were never before imagined.

McGrath [5] defined organizational creativity as value produced in a collaborative effort to generate new ideas and ways of solving problems by integrating various scientific knowledge. While others already highlighted the relevance of creativity both inside and outside the organizations [6, 7], prototyping fosters imaginative participation by all city stakeholders.

Our culture does not have many cross-disciplinary people. The persistent Anglo-Saxon (English-speaking) problem of the 'two cultures' (Science and Technology versus Arts and Humanities) identified by C P Snow [9] will be a deep problem for those planning future

cities and new economic models. Science fiction, art and design have a great deal to offer the future cities project, not just technology, architecture and engineering. How do we break the false dichotomy between these two approaches and get them interacting? Prototyping in its various forms (the visual, not just the literary) allows researchers to conceptually "*test drive*" their future city and new economic plans, incorporating the human angle on technological change. There is a deep tradition of dystopian SF exploring the problems of future urban life, for example John Brunner's Stand on Zanzibar [17]. Science fiction is the royal road to more joined-up thinking.

Cities are complex entities, like cells. They do not work simplistically but are composed of many technical, social and physical systems that interact in myriad ways, like a human body or an eco-system. If something goes wrong with such a complex entity, it takes a long time to cure. If a city is to change, it takes time. Again, it takes time for deep structures to have an effect on smaller, more subtle structures. Prototyping is ideal for modelling these long-term changes, especially their human impact. Again, there is a deep fictional tradition of writers exploring the evolution of cities over decades (and even centuries) – for example, "*Cities in Flight*" by James Blish [10] and the "*City and the Stars*" by Clarke [11]. Alvin Toffler in the "*Future Shock*" [12] began a trend to understanding the long run impacts of technologies on future societies, their economics, health and social well-being; with prototyping we are not trying to answer definite research questions but more rather working with business and communities on an equal footing to find out the right questions which need answer.

2.1 Logistics trends – insights and projections

This section reports my conversations with Dr Chris Caplice director of the CTL (details presented in Appendix 1). These ideas were subsequently evidenced and then expanded

through content analysis of over 15 back editions of the "*MIT Supply Chain Frontiers*" newsletter of their "*Global Scale Network"* (an international alliance of research and education centres). The issues included: Issue 36 (Spring 2010) through to Issue 51 (Fall 2013) [8].

Caplice identified four macro-logistics trends reshaping city and new economic model supply chains – with: "*most of the impact being felt on the retail side of the equation, though all industries will ultimately be affected*".

- **Product densification** – example: Tide. "*More ingredients, less water*". As products get more dense, shipping costs for those products fall. Electronics have long followed Moore's law and gotten smaller and smaller for the same functionality, but even toys, thanks to Walmart's effort around supply chain-smart packaging initiative, are getting more "dense".

- **Virtualization of sales** – example: "*omni-channel*"[1] fulfilment. When the sale and the fulfilment can be decoupled, it opens up all new opportunities in distribution. Caplice suggested: "*that omni-channel is in an innovation phase, where there is yet to be a dominant design defined. Retailers don't like to hear those kinds of things, because it means they have to make asset-intensive investment decisions during a time of high uncertainty, but if they don't try, they may never discover the right way to address fulfilment and inventory management for their Omni-channel*".

[1] Omni-channel retailing is the evolution of multi-channel retailing, but it is concentrated more on a seamless approach to the consumer experience through all available shopping channels, i.e. mobile internet devices, computers, bricks-and-mortar, television, radio, direct mail, catalog and so on. Retailers are meeting the new customer demands by deploying specialized supply chain software.

- **Decentralization of production** – example: Keurig. "*It costs a heck of a lot less to make a pot of coffee than to brew the equivalent number of cups using a Keurig machine*". However, the trade-off is choice – you don't have to drink an entire pot of the same coffee, so even if the unit cost is more expensive, the unit more closely matches the desired unit of consumption. The unit price is higher, but there's less waste – you only print the pictures you want. We may well reach a tipping point in supply chain where local manufacturing becomes more cost-effective: "… *decentralization of production effectively means the end of mass economies of scale. And that could have a massive impact on supply chains that have been optimized for mass production overseas*".

- **Virtualization of products** - the extreme of decentralization of production is virtualization of products, and 3D printers make a perfect example. Some manufacturers are already using them in production, making things as simple as "*O-rings*" to as complex as "*replacement knees*". "*The important thing to remember is that the components still need to get to me. But that's a very different supply chain than the one that exists today*".

2.2 The future of urban logistics – the road ahead[1]

"*I believe the most important innovation to occur within transportation in the last several decades is that of software development and the revolution that is occurring in Transport Management Systems, and that it has the greatest potential long-term impact on how*

[1] This (secondary) data was also collected from the supply chain frontiers newsletter produced by MIT's Engineering Systems Division.

companies use and view transportation" (*Caplice interview. (Further details are presented in Appendix 1)*).

There have been four major advances in TMS over the last few years:

- ***Software as a Service (SaaS)***. This concept has been tried in the transportation domain (usually unsuccessfully) since the late 1990s (for example, Application Service Provider, or ASP, software). But recent innovations in cloud computing and a growing acceptance of keeping confidential data in the cloud has led to wider adoption of this delivery model for all types of software systems. This, in turn, has led to easier sharing of data between entities and more opportunities for collaboration among trading partners.

- ***Big-data analysis capabilities***. Transportation can generate mountains of data—from shipment records to bills of lading to price information from across the network. And as stated earlier, because transportation touches all aspects of a company, the data contained within the freight transportation network can be exceptionally valuable. "*But data is meaningless without the means to interpret it. Fortunately, software has gotten much better at handling massive amounts of data. We are already seeing the benefits*". For example, the usefulness of radio frequency identification (RFID) has been advanced by the new ability of software to actually do something with all of the data that is being transmitted, collected, and stored. In addition, faster systems and clever algorithms are allowing companies to use transportation data and all of its underlying signals gleaned from the market not only to benchmark current operations to the past, but also to create forward-looking, predictive analytics.

- ***Visualization.*** For a TMS, visualization used to mean maps. "*The old joke in the TMS vendor world was that the only thing maps were good for in a TMS was to help them get sold to vice presidents of transportation".* They were not very useful for actual day-to-day operations or for longer-term planning. Recent innovations in how data can be viewed and visualized are changing all of that. Simple, easy-to-use visualization software systems like Tableau, Qlikview, Spotfire, and even PowerPivot in Excel make it much easier to see patterns and outliers and to make sense of all of the data generated by transportation activities.

- ***Robust planning capabilities***. One of the biggest problems TMS developers faced was how to bridge the gap between highly sophisticated optimization planning systems and the real-time operational processing systems used each day. Optimization models tend to treat the world as static, with no assumptions of variance or randomness of the input variables or conditions. This led to very rigid and fragile plans that fell apart when any disruption occurred.

Caplice believes: that transportation will continue to play its primary role as a "bridge" and "*shock absorber*" for future cities, urban supply chains and new economic models. But, as we have seen, the transportation function can have a much broader impact on how companies manage their businesses. "*Technological innovations that reduce variable costs (natural gas pricing), as well as infrastructure changes (e.g. Panama Canal expansion and railroads connecting China and Europe) could change how some companies organize and manage their supply chains. In addition, improvements in software within transportation management systems are expected to lead not only to greater efficiencies in the physical flow of goods, but also to the uncovering of additional insights from transportation data*".

Finally, he suggested that: "*The software improvements discussed above are enabling companies to mine more insights and value from their transportation data but also to better control their global freight operations. One could make the argument that the information contained within the traditional transportation-transaction data is almost as valuable as the product being moved—if it is adequately mined and analyzed. But that could be the subject of another (longer) article*". (*Quoted in Supply Chain Frontiers, Issue. 51: 1*) [8].

3.0 Developing a prototyping context

The focus of my investigation was to explore the impact that four logistics trends could have on future city and new economic model planning. In order to develop a prototyping context, these trends were projected forward to 2037, using the structural axes of (future) *resource availability* and *global trade*. Two plausible futuristic strategic alternatives were developed with CTL staff: "*Global Marketplace*" and "*Millions of Markets*". These provided the scenario contexts for participants to develop their own individual fictional narratives.

3.1 Global marketplace narrative - 2037

U.S. firms have established and maintained intense collaboration with companies across the world. The private sector has taken the lead in addressing the pressing issues of the day. Any attempt by governments to get involved in regulating business is seen as unnecessary intrusion. Citizens trust markets and they are willing to allow them to "work the magic". So far their patience and confidence in market forces has paid off. Case in point is the now routine hassle-free immigration across most nations and the dramatic increase in global food production.

Traditional powerhouses such as Japan, Germany and the U.S. no longer control the capabilities and resources needed to manufacture highly specialized, high value products. Although developing countries are not on par with advanced nations yet, they have found niches and are investing heavily in developing their industrial competencies. To exploit their comparative advantages, countries are specialising in producing what they do best and rely on other countries – halfway across the world in some cases – for everything else that they need. The interconnectedness and speed of this global market has a very clear downside as well: increased volatility. For example, a labour strike in South Korea can have huge ripple effects in a Madison, Wisconsin manufacturing plant. As a result, firms are taking extensive precautions to keep the flow of goods both smooth and secure.

Affordable and seamless supply chains are encouraging companies to invest in global manufacturing capabilities with most large firms using a mix of offshore and near-shore plants to remain low cost and flexible. The cost of moving goods anywhere in the world is very reasonable, primarily due to new and cheaper energy sources and technologies and non-obtrusive environmental regulations. Energy costs, although relatively low, remain extremely volatile because of the continual natural and man-made supply disruptions of oil based fuels.

Raw materials and commodities are brought to the market from all over the world, as there are minimal trade barriers limiting their availability. The free flow of goods is, however, driving extreme volatility in commodity prices, which is a persistent problem for most firms. Therefore, price rather than access – is the key criterion for choosing a commodity item. Postponement of final product customization until the very end has led to higher value density in products being moved within the United States. Retail sales are predominantly conducted online, even for grocery vendors. With a significant proportion of the U.S.

population living in large and dense cities, individual delivery to residencies is the norm in most retail transactions.

The collaboration between firms across national boundaries has further expanded the markets to the point that they have overlapped and blended into a single, global market, with a minimal set of regulations in place. It is said by cynics that, in this brave new world, "*the only regulation is that there are no regulations."* Finally a true global marketplace has emerged, where ideas, technology, labour, and goods are exchanged freely and quickly.

3.2 "Millions of markets"

The past three decades have been witness to tremendous technological advances and social changes that have led to a high level of regional self-reliance in matters of energy, health, food, production and manufacturing. Not only has the U.S. as a whole become highly self-sufficient, individual regions and cities have also become more self-sustaining. The primary drivers of these changes were technical breakthroughs that are collectively referred to as the "*Three Pillars*".

The first pillar is energy independence. Advances in drilling techniques and improved seismic testing enabled the economical location, capture and production of tremendous quantities of natural gas from massive shale formations along the Atlantic coastline. At the same time improvement in the safety and efficiency of nuclear generators led to a "*nuclear renaissance*". Renewable energy sources such as solar and wind power, while still being pursued have had only a minor impact on the total energy production. Natural gas and nuclear power have led to almost complete energy independence in the U.S. and have facilitated the

widespread decentralization of affordable and stable energy production. This contributed to initially hybrid but eventually completely electronic vehicles.

The second pillar is the widespread use of intelligent manufacturing. These advances enabled the production of small to medium batches of a wide variety of products at reasonable costs. Essentially the cost advantages of leveraging economies of scale that dominated manufacturing throughout the past several decades of the 20th century were replaced by the ability to cheaply produce a wide range of highly customized products. While manufacturing has not advanced to the stage of "*home replicators*" that enthusiasts once envisioned, it has led to the development of regional manufacturing hubs across the country. These manufacturing facilities are close to consumption centres and are fuelling the expectations of consumers for rapid creation and delivery of highly personalized goods. A key innovation that transformed the manufacturing industry was the separation of the digital design from the physical production process. This has in turn lead to the creation of a new industry sector of pure digital design firms that develop and sell small-run or custom designs.

The third technological advancement was the widespread adoption and use of virtualisation. Working and shopping from home – or from any other location – has become the standard rather than the exception for many people. Most households order products directly from the home and receive them there as well. Online shopping with prompt delivery to residences has largely replaced physical stores. People still go shopping in person – but the retail experience has evolved into an event rather than just a way to acquire physical products – similar to how movie theatres adapted when home entertainment systems were introduced. As goods and services have become more mobile than people, there is less physical commuting to work.

Ironically the level of travel for pleasure has increased since a large percentage of the workforce can work from any location.

A social change that has emerged over the last several decades is the increase in social interaction – both virtually and in person. It appears that while people can now work and live totally isolated from other humans, very few actually do. Instead there has been a groundswell migration towards "*liveable cities*" of a moderate size where people can enjoy the benefits of interacting with others in an urban setting without the drawbacks of an impersonal mega-city.

In this widely fragmented yet highly connected society, small and mid-sized cities are growing at a faster rate than the mega-cities. Local governments compete with each other to attract investment to create "*innovation clusters*" that feature a mix of technology, manufacturing, and distribution facilities.

Technological advancements and cheaper energy have ushered in a new age of affluence; average household income has increased, personal consumption has soared, and standards of living have improved. It is not a technology-utopia however. The income gap has widened between the traditional "*blue collar*", "*white collar*", and the newly established "*no collar*" creative class. Many traditional jobs have been displaced and those workers struggle to find new vocations. Also while new agricultural techniques mainly genetically modified fruits, vegetables, fish and livestock have significantly increased the quantity and variety of food products available to consumers there has been a significant amount of resistance from some sectors of the population. Food considered "100%" organic is generally available, but at a higher cost. In this fast paced environment the optimal production site is closer to consumer

centres. The affluent and savvy buyers of this world demand products customized to their needs and tastes. While American consumers prefer locally produced goods, they are not inherently against foreign products, provided they meet their high expectations of personalization and delivery speed.

Trade between countries is still active, but for the first time in history, the value of imported and exported services exceeds that of goods. The U.S. is a net exporting country when considering services such as digital designs. Physical trade still occurs but at a lower level and in different forms. For example, global trade of raw materials has increased while transportation of finished goods has decreased. Raw materials and components are transformed into goods when and where demanded by the final consumer. Also, intellectual property that is used within most local manufacturing is traded freely across the globe although there are some risks concerning the theft of these "recipes" and instructions in certain areas of the world.

4.0 Prototyping scenario development – research method

All workshop respondents were asked to read through the scenario contexts (presented above) and use them as a starting point for developing their fictional narratives

4.1 Workshop organization

Each workshop began by asking the participants to distinguish between the two scenarios ("*global marketplace*" v's "*millions of markets*") on the following dimensions: global trade, resource availability, energy cost level, energy cost variability, level of environmental awareness, population dispersion, energy sources, level of migration, migration policy and currency fluctuation. Full understanding of each scenario and its implications was deemed vital before the participants could then craft their own fictional narratives.

The general framework for each prototyping workshop was the same. There was an introduction to the concepts and approach followed by small group immersion and breakout sessions, with a final group debrief and discussion. Within this general structure however each workshop was designed differently using the following nine key components which are in a rough chronological order as they should be selected:

- Scope ("*millions of markets*" and/or "*global marketplace*")
- Objective (visioning/or evaluating)
- Duration (half day)
- Participants (workshop one: eight participants (everyday citizens (n =3) and science fiction writers (n =5); workshop two supply chain and operations managers (n =7).
- Strategic questions (to provide input and guide participants decision making)
- Evaluation elements (future technologies, cities, communities, new economic models)
- Evaluation mechanism (plausibility, logic, ideology and rationality underpinning story construction)
- Scenarios (fictional or foresight based scenarios)
- Debrief and follow up interviews.

The participants were each given a month to write up their own narrative and these were submitted to me by email. While the first workshop took place off-site in Newton-Highlands (suburb of Boston) the second took place in the Executive Room of the Sloan School of Management.

In order to achieve data convergence (between the scenario data, digital economy technologies, future cities and "*human-driven*" fictional narratives), Lowe's QCM (qualitative coding matrix) procedure was implemented [13]. This involves converting the

qualitative data into numeric codes. There are three phases of analysis. Phase 1: is the basic "*open*" coding or labelling of the data; phase 2 is more advanced "*axial*" coding where initial linkages between data clusters are established and; phase 3 "*selective*" coding where data patterns are established, interpreted and synthesized (triangulated) with other data sources. The final results are presented in the next section.

5.0 Results: Data convergence/synthesis

The results of the analysis are divided up into the following sections.

5.1 Future Cities- Boston 2037

The Boston in 2037 consisted of eight short snapshots into the imaginary lives of people of different demographics ranging from young children to elderly retired people. Further details of the workshop where these narratives were generated are presented in Appendix 1 (refer to the bold heading "*prototyping workshop Future Cities*"). The stories were set in varying environments including home, school, café, restaurant, downtown, etc., and depicted everyday situations where new technology helped the characters in different ways.

Adhering to the vision of ubiquitous computing, the stories were all very *optimistic* - technology was there when needed, never failing, and never used for malicious purposes. The stories featured scenarios ranging from the ordinary (controlling home appliances through smart phones) to the extraordinary (a holographic guide dog). Popular settings for the stories were public and shared indoor locations such as cafés, pubs, and bars, where technology was used to perform various functions including ordering beverages, paying the bill, using place-based messaging services, etc. From the stories it was possible to identify themes related to the three concepts namely: "*spatialization"*, "*temporalization"*, and "*embodiment"*.

Spatialization was discussed in several stories where the characters moved about in urban spaces, navigating unfamiliar paths with the help of technology.

> *The greasy receptionist waved his hand. 'Go ahead, the writer will show you the way'. Spike stared at the young man. Lunatic. The dog barked and started dancing towards the large revolving doors of the hotel. 'What the hell, let's go', Spike said and followed the dog.*

Temporalization also featured in several narratives, mainly in the form of characters needing to know when given activities were available, or when certain locations such as shops were open. In the stories technology was seen as close to all-knowing, able to provide information on any topic upon request.

> *The young couple make their way towards a nearby restaurant in the hopes of dinner, but at the door are told that the restaurant is full of fans celebrating the success of a local ice-hockey team, and the overall atmosphere seems too rowdy for a romantic candlelit dinner anyways. Maren checks his smart device, and finds the reservation status of all nearby restaurants. He makes a reservation to an idyllic bistro that's only a block away. At the restaurant door their reservation is easily found by touching Maren's device to that of the doorman, and the couple is shown to their table.*

Due to the nature of the stories and their settings, embodiment was found in every story – characters interacted with their environment through their bodies, by physically manipulating digital interfaces or simply by moving about in an augmented space. A common denominator was that bodily interacting with public technology was seen as very natural and effortless, and the characters were intuitively aware of where these interfaces were located. Further, the characters were not worried about things related to privacy, but were rather eager to share even their most personal information with the imaginary systems.

> *I finished my coffee and began planning my schedule for the rest of the afternoon. My wardrobe was in dire need of updating, and the shops were open for a few more hours. I knew of a public display a few blocks away, where I could have my strategic measurements up to my shoe size digitally taken. After this the computer would search all nearby stores for clothes that would fit me – I could browse the selection on the screen, and after that march on into the store to purchase the items I had picked out.*

The humorous story "*Where I am?"* depicts events over a 24 hour period, revolving around an apparently demented elder female character, who navigates various everyday situations with the help of her intelligent wrist computer.

'Sit here for a moment, while I go to the restroom. How about you read the MBT company's magazine?' Sandy, a nurse from Rhode Island if I remember correctly told someone, possibly me. Her eyes darted to my left wrist, to the screen of a gadget with an animated smiling face.

'Seems you have enough battery, spouse you'll be fine without me for a bit', she said and left me by myself at a small table with the paint flaking off.

'Hi Sandy we are at the North Boston railway station', the smooth masculine face on my wrist gadget said, appearing to be looking around.

'How on earth can this thing speak', I said to myself. 'These modern times are just full of wonder'. I looked at the device, then at my hand, which looked dry and wrinkled. 'Could use some lotion, to be sure...'

The face lit up. 'Would you like some lotion?'

'Yes please', I said, stroking the freckled back of my hand with the other, equally dry hand.

'By golly, where am I?' I looked around. In a shop.

A rotund woman dressed in a red shirt and an indecent black leather corset handed me a small black plastic bag. 'Here's your lotion. That'll be 15 dollars'. The woman extended her arm, and the device, which looked like a wristwatch beeped almost simultaneously with my own.

'The Casino at Newton Highland just charged your account for 15 dollars', my wrist device stated.

'The Casino at Newton Highlands? By golly, where have I gotten to now? I have got to get out from here, my oh my'.

I limped to the door, but didn't have to courage to go out. 'I can't leave, there's too many people! They'll see where I'm coming from!' I exclaimed to myself. The lady behind the counter tittered.

'There is one passer-by outside. Not very close', my wrist gadget stated and started showing a map of the nearby streets with a green and a red dot.

'Well, that's a relief, but where am I going to?'

'The next bus to the Rhode Island leaves in seven minutes. Showing route now.' The map changed to showing a route in red, and a compass.

‘By golly, where am I? In a car?’ The gadget, secured to my wrist with wide leather straps, blinked to life.

‘Hi Sandy, you are on a bus headed towards the Rhode Island. We are almost there. I will signal the bus to stop’.

The apparatus vibrated shortly, and the stop-sign towards the front of the bus lit up. The bus slowed down eventually coming to a full stop. I stepped carefully over the curb and onto hot asphalt. I was followed by several young men and women, some of whom were very loud. One was carrying a can of beer - in public, oh dear! The bus doors shut with a whoosh, and the car left. I remained at the stop, looking at the peculiarly dressed youngsters.

‘Public Transportation Services of Boston just charged your account for 1 dollar and 23 cents. Distance travelled was approximately 0.9 kilometres’, my gadget stated in its usual monotonic drawl. The screen flickered from showing a face to map and compass.

‘Your destination is less than 100 meters away’. The hands of a young, bald man grabbed me.

‘By golly, young man, keep your hands to yourself!’ I screamed, again wondering where I was. My memory was playing tricks.

‘Might I check your bag?’ The same rude young man asked and took the plastic bag from my hand, as if I’d given my consent.

‘Okay, thank you very much’, he said returning the bag to me. ’Grandma’s got a wild night planned I see, ha ha. Anyway, we’ll charge you automatically based on your location, feel free to roam the festival area’.

‘What are you laughing at young man? My poor old skin is dry’, I replied, suddenly remembering what was in the bag. The man exploded with laughter, doubling up on himself with mirth. How very, very rude. I looked around. A huge crowd of people, mostly youngsters, colourful tents and music. A pervading scent of food. ‘Where am I?’

‘You are at the Qstock festival. The program is as follows...’

‘Oh, there you are!’ A distantly familiar voice interrupted my wrist apparatus. Mary-Beth.‘I only went around the corner and you were gone. Thank goodness for that device.’ Mary-Beth looked at her own wrist apparatus. ‘How would demented people get by without it?’

This story depicted scenarios and technologies that were imaginative yet plausible, and while the story was focused on an elderly woman, it also featured personas from various demographic groups as supporting characters. In other stories the users of technology were

mostly depicted as young citizens spending time in restaurants, bars and cafes. This story successfully created transitions from one situation and space to another but also created dark forgotten temporal spots due to the dementia of the main character. The urban rhythms of the story were constituted together with other pedestrians, as well as with cars and buses. Space and technology were experienced through bodily practices when the talking wristband both gave the user the information she was asking for, and gave orders about her movements as an independent actor. Her moving in the city space shifted between necessary activities, like shopping for body lotion, and resultant/social activities, like spontaneous visit to the rock festival, though this was not dependent on the user herself. The narrative was restricted to the period of one day, and thus the temporal rhythms were not connected to seasonal or even weekday changes.

5.1.2 Assessing future city visions and the global context in 2037

Overall, the stories painted a picture of a society very much adhering to the vision of *calm computing*. Although the vignettes were positive about future technology, this was technology as functioning in an "accessory" role in support their city living: the workshop participants however were a lot more pessimistic of the notion of "*smart city*" visions[1], and the digital economy directly changing their lives and regenerating the local infrastructure and economy of Boston. It was suggested by participants at the workshop that smart cities were rather utopian concepts "*one business group's vision which is felt to be the right one*". There was general agreement that there were often many visions for the city but "*at the moment it's the rich and powerful who determine that future vision*". Also many were troubled by the

[1] A city can be defined as 'smart' when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory action and engagement [19].

notion that people would live in a city purely because of its technology capabilities, most thought that there were lots of other important social and cultural reasons influencing people's decisions to live and/or work in a city including: the natural environment, history and legacy. One participant suggested that: "*people love diversity between cities not uniformity. Also we get clustering effects around certain cities if they are a capital city, airport, freight terminal, financial capital, cultural city…. Technology should only have a supportive role*".

The problems of engaging the young in future city planning were also emphasised. "*SF is not really linked in enough with them, most of which people consume tends to be dated and more commercialised version with low science value. So usefulness in attracting future generations into science and technology mitigated a little*". All participants felt there was a critical need for policy-makers and scholars to engage with the youth of Boston, but this would require much greater imaginative research techniques than a survey.

Brasilla was cited as a failed future city vision and these are dotted around the world. One participant noted: "*that there would come a time when the population growth would slow down and the pressure on resources may not be as intense*". The threat posed by the rapid growth of resource hungry China to the economic wealth of America's cities was also noted by several other participants. More care should also be taken it was suggested, by those firms bringing goods and services into cities: "*they should be tasked with not only supplying the inputs into cities but also looking after the outputs and external costs of their activity once those goods are available and being consumed*" [17]. People questioned the appeal of living

somewhere like Masdar City[1]. Increased segregation in cities and the welfare costs was noted as an indication of widening societal gaps that could occur if smart cities became a reality.

The group generally enjoyed living in Boston and many had migrated there from either other U.S. cities or other countries. It was seen as a friendly and progressive town with a promising future ahead of it. A key message was that people needed to start living smarter, cleaner and efficiently now, if their grandchildren would inherit a comparable or better Boston in 2037 to that which they lived in now. For instance, there needed to be much greater provision for cycling (bike lanes), more sustainable transport and eco-friendly innovation. None of the participants wanted a bland "*Masdar type of city*", they all wanted something similar to what they have now, but with improved sustainable and eco-friendly modifications. Circular looped rail systems as in London and Paris were favoured and the reduction in cars in downtown Boston. But then there were fears that this would: "*simply push the problem of congestion out of downtown into the suburbs through such a policy*". The group also confirmed the views of MIT's Dr Edgar Blanco that: "*we've been great at using logistics to get something to you. What we haven't been so great at is getting that thing that we gave you back. Trying to extract more value either as materials that you can recover, recycle, or maybe even to give that same product to other people after you're done with it* [8]".

[1] Masdar City (an arcology project in Abu Dhabi, UAE) is the latest of a small number of highly planned, specialized, research and technology-intensive municipalities that incorporate a living environment, similar to KAUST, Saudi Arabia or Tsukuba Science City, Japan. Designed by the British architectural firm Foster and Partners, the city intends to rely entirely on solar energy and other renewable energy sources, while conforming to a zero waste ecology policy (and the creation of a sustainable zero-carbon car-free city).

5.3.2 Future business models, technologies and products

While the first three narratives were linked to the theme of "*product customization*", the other four narratives were generated from intuitive forecasting of trends in "*localized manufacturing*" and "*craft-based production*". Details of the workshop are presented in Appendix 1 (refer to the bold heading "*prototyping workshop strategists and supply chain managers*").

5.3.2.1 Fully Personalized Products

The first scenario explores the application of future intelligent scanning technology which generates individualised information so as to develop personalized hair care products. Every person's hair is unique so products are designed specifically for you.

> *On the dining table there is a box. 'Perfectly You, by Pantene' says the label, with large burgundy letters. Gloria smiles and opens the box. Inside she finds five bottles. She takes the largest bottle out of the box. Besides the brand name, the bottle has Gloria's name neatly imprinted as part of the label, the word 'Daily Step 1' and a list of the ingredients. She opens the bottle and smells the soft fragrance of sandal wood.*

The lead character Gloria lives in Fenway[1] and works as a corporate lawyer in a medium-sized firm in Boston. Married, with one child, she strives to balance the demands of work and of family life. She does not have so much time for herself as she would like, so she enjoys the few minutes that she sets apart for taking care of her hair every day. The character is designed to reflect the upper middle class segment of consumers who are well educated and have good affluence, so they can make intelligent choices regarding their consumption.

[1] Fenway–Kenmore is an official neighborhood of Boston, Massachusetts. While it is considered one neighborhood for administrative purposes, it is composed of numerous distinct sections (East Fenway, West Fenway, Audubon Circle, Kenmore Square) that, in casual conversation, are almost always referred to as Fenway.

She takes the other four bottles out of the box: they are labelled 'Daily Step 2', 'Weekly Nourishment', 'Sunny Shield' and 'Finishing Touch'. The number and formulations of all these products were perfectly customized to match the needs of Gloria's hair type, styling preferences and living habits.

The question that intrigued me with this scenario was how did Gloria find out about "*Perfectly You*"?

Gloria had seen some of Pantene's ads about personalized hair care products, but thought they were only 'for the rich and famous'. The recommendation of a close friend from the office, Cori, convinced her to give the personalized hair care products a try. Cori had been using these products for a while, and she took Gloria to her Hair Salon in a Shopping Mall attached to the baseball stadium (Fenway Park).

The key future technology is the "*hand-held scanning*" device which constructs a DNA profile of your hair.

Mario, a hair specialist who carries Pantene's 'Perfectly You' line, scanned Gloria's hair with a handheld device. This device determines the relevant properties of the hair and scalp, such as shaft form, serum production, and hair colour, tendency to suffer split ends, tangling and frizz, and many others. Mario also asks Gloria some questions about her habits, environment, preferences and the time she has available for her hair. Based on Gloria's answers, and using an expert system provided by Pantene, Mario presented Gloria the proposal of a five-product fully personalized hair care line.

The data generated for each user from the technology is then fed directly into product line development.

i. *Daily Step 1 is a soft cleanser.*

Gloria told Mario that she usually takes a hot bath every day, and likes to wash her hair almost every day, to remove the dirt that accumulates in a polluted city like Boston. An optimal mix of detergents was selected for the formulation, to effectively removing dirt while protecting the hair. Mario explained to Gloria that, in spite of what consumers usually think, the foaming, fragrance, thickness and opacity of a hair cleanser are not relevant to its cleansing properties. Gloria decided that she wanted very little foaming and thickening components, and no opacifiers at all. She did ask for a slight sandal fragrance. She has dandruff problems, so the cleanser includes an ingredient to address this problem, in the exact concentration to prevent the appearance of dandruff in Gloria's scalp. The cleanser also includes several specialty additives especially suited for Gloria's needs.

ii. Daily Step 2 is a soft conditioner.

This is to be used after the cleanser. Gloria is from Hispanic descent, and has dark, curly hair with a tendency to frizz and split ends. The conditioner formulation includes ingredients to optimally address each one of these points, in the perfect blend for Gloria's type of hair and environment. Gloria had never found a conditioner that 'really understood' her hair. Some would kill its curls, others would leave it dull. Mario promises Gloria that this conditioner will give her hair the look of healthy, clean hair because it has been prepared with her in mind. It also includes a component to enhance Gloria's natural hair colour.

iii. Weekly Nourishment.

This is a deeper conditioner that Gloria can use after swimming, to condition her hair and repair the damage from the chlorinated water. Sunny Shield is a lotion that Gloria can apply when she goes sailing to prevent hair damage from prolonged exposition to the sun and salty breeze, which includes a UV blocker and other protective ingredients.

iv. Finishing Touch.

This is a styling liquid that Gloria can use on special occasions. She usually likes her hair to look natural, but when she feels like styling it differently, for a holiday dinner with the family or a party at the office, she can apply this styling aid to her hair. It will provide her with a flexible hold that washes away easily in the next shampoo. The strength and concentration of the holding ingredients was chosen considering the structure of Gloria's hair and her styling preferences.

All of the products of Gloria's fully personalized 'Perfectly You' line are free from ammonium xylenesulfonate, which Mario thinks could irritate and dry Gloria's scalp. Mario told Gloria that the personalized lines of other customers had a different number of products, each one with a custom-made formulation, which could be adapted later if the preferences of the customer changed.

After reviewing with Mario the proposal presented by Pantene's expert system, Gloria decides to sign up for the "*Perfectly You"* plan. The cost is somewhat higher than that of non-customized hair products, but based on Mario's advice and Cori's experience, Gloria thinks that they are well worth it. The first batch of five products was accurately prepared by Pantene and delivered to Gloria's home within a couple of days.

The focus of the story is on technology enhanced product-driven customization. Mass customization — where customers can tailor a product's appearance, features or content to

their own specifications -– has been the "*next big thing*" for a long time. As far back as 1970, the futurist Alvin Toffler predicted its emergence. Customization expert Joseph Pine in his seminal book "*Markets of One"* suggested that customization would change the fundamental structure of the American economy [14].

Yet for years, mass customization largely failed to take off. Worse yet, big brands have tried and failed with customized offerings. Levi Strauss offered customized jeans from 1993 to 2003 but failed to offer the kinds of choices to consumers -– like color -– that would have made the offering successful. Dell, once the most prominent practitioner of mass customization, recently declared that the model was no longer sustainable for them as it had become too complex and costly to continue. However there was a general consensus among the participants that the digital economy is fundamentally changing the way customers interact with brands and products. "*Mass customization*" could it was felt have an impact on local economies by offering an exciting alternative to the "*mass-produced, price-is-everything Asian factory model"*.

However the plausibility of the "*millions of markets*" scenario was questioned. Could local production chains would need be designed to reach customers quickly (short lead times) and, would there be sufficient highly skilled labor available and enough significant investments made in both customer-facing and back-end IT systems. This story for me is a speculation about the "real" asset contribution that digital technologies could provide local producers by interjecting buyer participation into product design.

5.3.2.2 The natural way (2037)

This narrative focuses on the character Andrew who represents part of the 40% of Americans that can be described as "*green citizens*", a group of people who belong to the working middle class, and that buy "responsible" products, even if they cost some 10% or 15% more to buy. "*Green citizens*" were once a tiny segment of the U.S. consumer product market a decade or so ago, limited to some die-hard "*tree huggers*" and other unusual characters. But as the municipal governments started to give incentives to citizens, in the form of tax breaks and other ways, to lead more environmentally-friendly lives, and more importantly, as the effects of human activity was starting to become more evident in the environment, the number of "*green citizens*" multiplied exponentially.

> *Andrew read in the paper that, according to the U.S. Census, in 2037 around two out of three Americans are living lifestyles that fall within the category of what is considered a 'green citizen'. The term 'green' was coined because originally these consumers preferred groceries and consumer products that were environmentally friendly. However, with time it widened and now mainstream 'green citizens' prefer products that are so-called 'responsible' in three dimensions: the environment, society and ethics. In this context, social responsibility means conducting all the business processes, from sourcing to recycling, with respect to social wellbeing, e.g. not sourcing materials from countries that do not respect human rights or labour regulations, and so on; and ethics is understood as conducting business according to an overarching purpose of doing no harm, e.g. not testing on animals, etc.*

Andrew works as a waiter in an upscale organic restaurant in Boston. The pay is not bad and the tips are usually generous. The only downside is that the shift requires him to work during the night, so his "*whole biological clock is upside down*", as he says. He is taking classes at MIT, "online", e.g. through the network. Although he is far from being an activist, he considers himself a responsible citizen and lives according to some principles of environmental, social and ethical responsibility.

The main focus of the story is on the gift he receives from the editors of "*New Planet Magazine"*, which they sent to all of its male subscribers.

> *It was a small gift set of three products for hair care, from the line 'Natural Way'. The letter that came with the products said that Natural Way hair care products were not only great for the hair, but more importantly, they were manufactured to be harmless to the environment.*

Andrew tries the products when he showered this afternoon, after running five miles on his exercise machine. The first product was a cleanser liquid, the second was a nourishing liquid, and the third was a styling mouse that promised "*a fresh, healthy look*".

> *Andrew smiled when he read that description, but was surprised to find that he actually liked the products. They had a weird colour, and were very liquid, with a slight fragrance, but they worked. He felt that his hair was clean and looking good, after he applied the products that afternoon. 'Ok, so that wasn't too shabby', said Andrew in front of the mirror. 'Now let's see if the other half of the story is true, too'.*

Navigating in the "*Natural Way*" hair care products portal, Andrew quickly finds the answers to his questions. The portal is designed in such a way that relevant information like this is prominently displayed. Natural Way is oriented towards one of the sub-segments of the "*green market*": young males with active lifestyles.

> *Andrew verifies that all the products he tried that afternoon, and liked so much, are actually 100% responsible products. They were formulated without foaming agents, opacifiers and artificial fragrances, which would pollute water without adding value to the hair care process. The raw materials were sourced and the products were manufactured in a socially responsible way, respecting labour and human rights. And last, but not least, the products were not tested on animals. It would be very easy to do empty claims in a portal, but all these claims were verified by Gaia Veritas, a very respectable certification agency.*

At the end of the story, Andrew places his first order of Natural Way products: a cleanser, a nourisher and a styling aid, for his type of hair. He should receive them in a couple of days.

During the workshop, participants noted that the demand for environmentally friendly products had and was increasing dramatically in the U.S. However, as one participant speculated: "… *but consumers cannot be sure that what is inside the bottle, actually matches the promises on the label"*. While Canada and the EU have government-sponsored criteria for so-called green products, America (the workshop participants told me) lags far behind, especially for products used in homes every day. Product labels promise cleaners that are natural, nontoxic, environmentally preferred, or hypoallergenic, but in the U.S. there are no government or industry wide agreements on what the terms actually mean. The group told me that while America had made strides in some areas of labelling, especially for "*energy-efficient*" products and "*organic food*", yet still no clear standards exist for many claims on household-product labels. For instance, manufacturers do not have to list ingredients on those product labels, although some companies do.

As the workshop discussion progressed there was a consensus that making the strategic transition from a "traditional" business to a "green" business is fraught with challenges—including the unexpectedly hard marketing question facing companies today: Should we market to the green consumer, and if so, how?

The result is that most companies are stuck somewhere in the middle—and that turns out to be a very dangerous place indeed. This scenario demonstrates the need for the firm to define what "sustainability" means for their company and they (the firm) then needs to decide how to express those values in their offerings. The writer of the narrative was adamant that firms building new economic models grounded in the "green" economy or "sustainability" niches should stop: "*trying to appeal to green consumers by building green myths into the products*

they have and start creating something real—products that tell their environmental story for them".

For a company that wants to go green, then, the group felt that the green consumer niche is almost irrelevant. The scenario reminded me of Harvard Business School's professor Theodore Levitt's old marketing axiom that: *"people who buy drills don't need drills; they need holes. Consumers—whether they are green or mainstream—don't simply want green products, they want solutions to their day-to-day problems that also make sense for our environment"* [15].

5.3.3.3 Haircut 2037

This next scenario focuses on the saturated market of new hair products for young women. The developer wanted to focus on products for the 18-25 segment. How this might map out into the future? Her motivation was the "*millions of market*" context and for her the future implications would be a new economy based on millions of "niche" segmented business models. As competition for the localized market production intensified, new products aimed at the 18-25 demographic group was booming. The central character in her scenario was Milla who is notable for her strong educational background in Chemistry. Milla therefore knew that some of the ingredients they put in to hair care products being designed for the young adult/college segment: "*were, well... unhealthy (basically not good for your hair and scalp)"*. The issues here are of marketing exploitation and whether information generated from digital technology and your educational background could lead to less exploitative and more ethical business models.

Milla was happy to run into the "*So Cool*!" family of products. She saw an advertisement in her favourite e-magazine, and decided to give it a try. She found out that the brand encompasses about a dozen lines, each one with myriad different products.

> *The good news: their ingredients were actually safe, and good for your hair. Not expensive and at the bleeding-edge of fashion. New products were presented very often, and old products were phased out quickly, too. Except the best sellers.*

She checked the ingredients in all she bought, and tried to understand the formulations. They were innovative, but always on the safe side of the street. The blends were effective, they delivered the results as promised and hurt neither the pocket nor the hair. Most of the new products address both the usual concerns of the teenage consumer (anti-frizz, split ends, maybe restoring coloured hair and stuff) and her fashion demands. But others were really wild, including extreme styling aids, with very good hold, or amazing colours for the hair, and aids for shine, body and many other features.

> *Some of the trends are really out there, a little extreme: last Halloween, they came up with the fluorescent gel that glows in the dark. It was dope! Other fashion proposals are more low pitch, such as the new ultra-shine liquid that had caught Brad's eyes, that just enhance the natural colour of the hair, and help keep it healthy and looking flawless. The kind of hair you would kill to have.*

The key success factor in the firm building a sustainable business model was this firm's unique ability to build loyalty through constant innovation

> *Since Milla started using 'So Cool!', many of her girlfriends (her 'subjects', as she likes to call them) had started using them, too. Instead of following fashion trends, 'So Cool!' creates trends. Almost every month, they present several new innovative products for hair fashion, advertising them in teenage e-magazines and shows. 'So Cool!' was clearly the leader of the market. Most of the brands tried to copy their styles, or to come up with their own cool new products that flunked because of unsafe formulations or lack of results. The loyalty of Milla and her gang to this brand was based on the non-stop innovation of 'So Cool!' products, their commitment to safety and their understanding of what looks good.*

Milla didn't care much if a different brand was endorsed by the latest pop singer: she cared that the product would make her look beautiful, "avant garde", and not ruin her hair or her budget period. And almost every month she would buy some of the new products of "*So Cool!*", and try them. And she loved the results.

This story provoked a lot of follow up discussion with the group. The future market for the so-called "*Generation Y*", was one worth USD 500 billion [16]. In discussing the scenario one participant noted: "*as the young segment matures, young preferences will increasingly shape the development of 'millions of markets' (as a well as the digital world) as young consumers gravitate to and integrate certain local brands and activities into all facets of their personal and professional lifes*".

There was a general feeling among the group that business models needed to become more localized if they in they were to be relevant to this often over-looked influential group. This however requires, as one participant noted that: **"***business needs* to be a*gile in adjusting their product portfolio as quickly as consumers change their preferences and buyer behavior*".

5.3.3.4 Localized manufacturing

The story *Made in Boston*, focused on the vision of a future of high-end 3D printers being made readily available locally with high individual engagement in the processes involved.

> *My name is David and I was born in 2007. The shift seemed to just happen without anyone realizing. It was shopping-as-usual but behind the scenes everything was changing. In the back of the shopping centres the inventories, pallet jacks, shelf stackers all pretty much disappeared over night. In their place appeared rows of complicated looking boxes with little screens showing off even more complex insides. The technology seemed second nature to staff already used to printing paper. But these printers now produce most of the things we all want to buy with the added bonus of offering custom designs. Hardly any products say Made in China anymore except ones you pick up in the charity store or on computers and those kinds of things.*

The character in this vignette describes the experience of shopping for shoes and describes new financial systems as well as social issues around how consumers might be drawn, or reject, this new innovation: 3D scanning allows customization but this form of manufacturing is not as 'rapid' as anticipated:

> *Today I am going to buy some new shoes for a job interview. You can model the shoe you want online and then go and pick it up from the nearest outlet. I've already paid for it online with my credit card, but instead of selecting home delivery, I chose to try it on in-store instead. They have a policy where if it doesn't fit perfectly according to the scan I submitted for my feet they'll print another one. They also scan your feet in-store as well if you don't have your own scans, although the shoes don't print out instantly (now that would be cool); instead, you have to come back the next day.*

The wider logistics system is introduced in an associated scenario, *Buying Grandmother's dress*, here involving the aggregation of retail shops into single suppliers printing a range of products. As well the production of alternative kinds of products derived from customization and demands for bespoke designs, foretelling new business visions based on mass-customization rather than mass-production:

> *Many of the outlets print multiple products so you can collect toys for your kids as well as your shoes from the same place. I have an important meeting so I want some shoes that look good, but they've got to be comfortable too. I have brought along a piece of my Great Grandmother's old dress from the 1920s. The colour and design is just amazing. I'm hoping the store assistant will be able to scan it and print me some shoes to match.*

In this scenario the engagement of individuals with the technology is high, so that it is anticipated in the story that they are peer producers in the design process, a part of a business vision rather than a self-led movement. Here possible inspirations for involvement include comfort, convenience and aesthetic qualities. This might bring up some 'nostalgic' social practices, which supplant mass-production:

> *Of course, the comfort is important too. A couple of months ago I had some shoes printed and they fitted like a glove –it's amazing to the see the inner sole with the*

> *same curves and dimensions as my foot. My Grandfather used to say this is how they did it in the old days—everyone would have their own wooden 'last' carved to match their foot. He says it's surprising how long people tolerated ill-fitting shoes!*

5.3.3.5 Craft-based production

The final two stories were drawn from examples of co-production and collaboration in places of low corporate influence, such as libraries, government buildings, collectives, public/private partnerships, museums, galleries and so on. The first narrative here emphasizes low individual engagement so that the role of mediators and middle-people is paramount, either technical personnel or information managers. The use of 3D printing in community settings without profit is already being trialled in places. The Fayetteville Free Library (FFL) initiative "*3D Printing@ The Library*" in New York is one such example organized by community mediators. And this is the inspiration for this vignette, where the character Shannon goes to her local library to print:

> *My name is Shannon and I was born in 2007. Tonight after work I am looking forward to going to the local library for my weekly crafting group. A couple of years ago the council gave the library a big grant to purchase the new range of large multi-material 3D printers in a special centre designed for the community.*

The power of vignettes lies in capturing current technological issues in society and transposing them into the future. In this case issues arising from interaction with mediators, who engage with the technology on behalf of the users, and also in the use of a shared non-corporate community space:

> *At first, I was intimidated by the large machines (standing as tall as me against the wall) although they do look a lot like the centralized paper printer we had down the hall in my office, which always seemed to be going wrong and jamming! These printers all seem to work fine, except once when a young man tried to mix in his own materials; we found out he was trying to print using ground flour! From now on the technicians all watch the younger users really closely. I think they are also afraid of illegal and pirated items being printed. One of the printers still smells a little like burnt bread.*

In order to show relatively low engagement with the technology, the character's interaction with the library personnel and equipment is depicted, particularly emphasizing assistive technologies in support of the, most likely, underpaid or volunteer mediators:

> *There is a digital information officer on-hand most days to assist with converting the files we bring in from home or, for those of us who are real beginners, getting us set up on the computers the library provides for people in the community who don't have software at home. The software in the library combines together all sorts of templates in an easy to use interface. You simply select the object you want to make from a list, which you can change as much as you like with the haptic controller. The software on these library computers is far simpler than my home program, but I prefer the convenience of designing in my own time, so I attended a special course the library also offers once a month; I was so excited about what I learnt that I ran out and bought one of the small handheld 3D scanners! The first thing I scanned was my dog and the librarians all laughed when they saw the life-size replica emerging from the powder with its bemused expression.*

As in the other vignettes the wider systemic attributes of the 'world' are a crucial feature to convey to the workshop participants, including materials and the transportation of resources for printing.

In the final story it is hobbyists and enthusiasts driving innovation, such as printing model trains:

> *The craft group is as much a social occasion as anything else. We all bring in homemade cakes and have many tea breaks while the printers are working. We all help each other out and there are so many eclectic interests. My crafting friend Michael is running a small home business and sells his own range of model train accessories. We all marvel at the incredible detail of the little trees, houses and even animals and railway stations. He assures all his clients the parts he sells them are unique. He often uses old black and white photos, which he renders into 3D using special software. Every month we have a local maker-fair where we all have stalls selling our items and other homemade things.*

As in the other scenarios, unintended consequences were examined through his story,

in this case alternative financial systems and bartering

5.3.3.6 Assessing the future of cities, new models and urban regeneration

There was a strong sense amongst the participants in this second executive based workshop, of eco-driven innovation futures. Eco models needed to be improved in the city centres. Can we live, shop and move around more efficiently? There was a strong feeling that the Earth's resource problems are: "*not solved by going out to space (too expensive) but by recycling more of the Earth's resources*". One example cited was that of Helium, which has been detected on the moon but it's much easier/cheaper to recycle it. Cities like Detroit were cited as having grass-roots of recovery, but this "*was very much in small micro-units*". Again the participants really did question the extent to which these "*micro units*" (primarily local agricultural food production) would be enough to catalyse full scale regeneration of cities such as Detroit.

There was a real consensus among the group that "*smart cities*" would encounter expansion problems even if they were indeed successful. They cited the city of Portland which because of its success has had problems of controlling urban growth and the pressure this brings on the city infrastructure. There was a feeling that in the US the "*value of the future is zero and the infrastructure we are developing now, such as that of schools and roads was only being built to last for a maximum time span of 20 years. There's no real incentive to make things last*". It was clear there was scepticism in the group about the ability of technology infrastructure improvement as a source of urban renewal for those American cities in crisis or decline.

The topic of Silicon Valley came to the fore as the day progressed. This could happen somewhere else: "*but it's a chance probability a "spark" which will trigger a chain reaction and in essence an innovation production process down the road. The U.S. is creating this*

with bio-technology in San Fran and medical engineering in Cambridge. Pockets of growth stimulated by the inflow of a largely non-unionised international workforce". The success of entrepreneurs in the U.S. it was suggested was the result of the high rewards paid to the "winners" in a fiercely hedonistic and competitive system. Nearly all fail but for those few that succeed the financial rewards could be spectacular. It was a high reward entrepreneurial culture that provided a fertile ground for the development of future new economic models.

Boston had chronic problems with traffic congestion. It was felt that this was because it was cheaper for people to drive than use the public transit system. A key message was that people agreed with the ideology of the report's author that people needed to start living smarter, cleaner and efficiently. "*Further bike lanes, sustainable transport and eco-friendly innovation needs to be rolled out more*". Finally the group reminded me of the EPCOT vision for the city of the future (as an analogy to smart cities). What happened? The vision never went any further than being a purely speculative Disney prototype.

5.3.7 Follow up interviews (the female entrepreneurs)

Two of the participants at the second workshop were successful entrepreneurs. The first Valena told me how she had generated funding for her business. Her adviser suggested she look into the Samuel Adams Brewing the American Dream program, which provides microloans to food-, beverage- and hospitality-related entrepreneurs. Valena did, and received $4,000. The loan funded espresso catering service Voltage Coffee, which: "*allowed me to meet people and make a name for the company*", she says. As that business grew, she secured $150,000 in venture capital most of that through P2P loans and crowd-funding. By November (2012), Valena had a coffeehouse to call her own: Voltage Coffee & Art which opened in Cambridge, Mass.

Caitria was a (student) founder of Recovers.org an easy-to-use recovery software framework that can be deployed before a disaster to prepare communities. The start-up was the brainchild of two sisters at MIT whose idea for a business enabled them to be a grand prize winner of the MIT Ideas Global Challenge Competition in 2012, (a program of the MIT Public Service Centre). This provided funding and 15 month mentorship. Since then they have sustained themselves through grant funding and mentorship on several programmes, the Knight Foundation, Mass Challenge and Code for America.

6.0 Conclusions and future strategy

On my departure from Boston, Daniel Desai of Northern Eastern University was commissioned to expand the investigation to explore future transport mobility in Boston. The findings of which are attached to my report. As the work progressed I began sharing ideas and making collaborations with the Media Lab (where I organized a public forum with Prof. Guanguan Liang in July 2013 on the key findings (at the time) of my investigation), the SENSEable city lab, in particular with its director Prof. Carlo Raati and his associate Prof. Rex Britter, and Melvin King of the Community Lab. Also discussions with Ethan Zuckerman at the Centre for Civic Participation (on the role of civic participation in future cities and economic models for the news media) have given me many ideas to expand this research investigation over the next few months.

The key finding from the public symposium on my work on the 8th July was clear, that we as researchers must be careful not to widen the digital divide by further excluding certain demographic/social groups from the technology-oriented society of tomorrow. For the majority of those attending this was the first time they had visited MIT. However, a majority of people participating in my workshops had positive views towards future technology; my

material also revealed quite interesting set of visions combining organic images (derived from nature) with technology.

The vignettes demonstrated the use of fiction can be a powerful tool in visioning the potential human consequences of so-called 3D printing and localized craft-based production. A popular premise, being that 3D printing could permit many final objects to be made near to or even by consumers on just-in-time printing' machines. This revolution in making would have many implications for the economy-and-society in the future by seriously augmenting or indeed replacing, current systems of manufactured production and consumption all occurring at a distance.

The 2037 contexts were well received by the participants and the extracts used in the workshop seemed to blend well into the personal narratives. They also gave the workshop organizer a shape for projected future worlds enabling my participants to focus in on the specificities exclusive to each scenario. There can be no doubt that the fictional accounts enabled people to think beyond the technology. Logistics prototyping could be a powerful tool in the social science repertoire for dealing with the human complexity of issues surrounding future cities and new economic model planning.

In the final week of my placement at MIT, some inroads were made to share my work and build its impact at a policy level. Three interviews were completed and a conversation was initiated to look at future UK and U.S. collaborations. The focus would be on developing impact cases related to the influences of urban logistics on city and business planning. Cliff Cook of Cambridge Community Development Department was very positive towards the findings of the project and wished to use some of the findings, ideas and ideology to develop

his own funding proposals and further his plans to help regenerate parts of the Cambridge area. George Mokroy is a civic activist pursuing agendas of positive change and he was a strong advocate of using this work to engage and inspire sustainable economic activity especially amongst the young of Boston. He also foresaw the potential of my work for enabling the young to engage with future city planning initiatives. Finally, Mel King also saw projects such as this as providing a refreshing catalyst of change, that moved beyond dry and arid academic experiments in data collection and information supply. It's my intention to keep in touch with these three and all the other people who participated in this investigation.

6.1 Post placement thoughts – February 2014

My placement provided the opportunity to meet a variety of Bostonians working across the Digital Economy landscape, from small creative companies such as: Recovers.org; university anchored innovation labs; knowledge exchange programmes; the SENSEable Cities initiatives; and the Media Lab at MIT. There was a feeling that the convergence of imagination and digital technologies was critical for the future of the "*Mass Ave"* innovation eco-system experiment. This and the continuation of America's "hedonistic" and ruthless venture capital system (where thousands of models and ideas failed but for the few which did succeed the financial rewards were usually astronomical). It was evident that the bio-technology industries are having a central role in driving business and service innovation in the Cambridge area of Boston. The tech/creative collaborations are reflected in the emergence of dynamic clusters of small companies and organizations, using a combination of content, design and technology as the basis for creating viable business models. Not only in the domain of bio-technology, but also in providing a range of services and solutions for other sectors.

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Appendix 1: Diary of research activity

Nature of research activity	Date	Participants	Job title/comments
Interview	03.06.13	Sally Suznowitz	Assistant Dean and Director MIT Public Service Centre
Interview	04.06.13 15.07.13	Chris Caplice	Director of MIT's Centre for Transport and Logistics (CTL)
Pilot testing: prototyping context scenarios	05.06.13	5 MIT Faculty	
Prototype workshop (cities)	07.06.13	Pam Philips 8 participants (3 citizens; 5 SF writers)	Head of Boston Science Fiction Writers Group
Interview	10.06.13	Roberto Perez Franco	Postdoctoral Research Associate (CTL)
Interview	10.06.13	Guanguan Liang	MIT Media Lab Research Fellow
Interview	11.06.13	Kent Warner	Intel
Interview	11.06.13	Dick Myrick	MIT Agelab
Interview	14.06.13	Reid Williams	Shell
Prototyping workshop			
Stategists/Supply Chain	14.06.13	7 participants	Freight/supply chain managers (Boston area)
Prototype discussion	13.06.13	Jill Shokery	Boston Fiction Writing Group
Follow up protoype interviews	19.06.13	Sue Burton	Saltmoney.org
Interviews	21.06.13	Steve Wilmsen, Senior Assistant Metro Editor, Boston Globe	Boston Globe
		Meghan Irons, Reporter, Boston Globe	
		Akilah Johnson, Reporter, Boston Globe	
		Maria Cramer, Crime Reporter, Boston Globe	
		Chris Marstall, Creative Technologist, Boston Globe	

Interviews	07.07.13	Lira Kay	Boston Media Makers
		Johnny Pryor	
		Stephen R. Wilk	
Interviews	18.06.13	Carlo Raati	MIT SENSEable City Lab
		Rex Britter	MIT SENSEable City Lab
		Daniel Desai	North Eastern University
Interview	20.06.2013	Lucy Valena	Entrepreneur Voltage Café (Crowdfunding)
Faculty presentation	24.06.2013	Presentation to the MIT Centre for Transport and Logistics Faculty	
Focus Group	28.06.13	Sally Suznowitz	MIT
		Roberto Perez Franco	MIT
		Rex Britter	MIT
		Carlo Raati	MIT
		Dick Myrick	MIT
		Anita Greenhill	MBS (Skype)
Planned future transport mobility project	28.06.2013	Daniel Desai	North Eastern University
Public Symposium	08.07.2013	MIT Media Lab public symposium (50 people attended!!)	
Dean Meeting	11.07.2013	Meeting with Cynthia Bernhardt Engineering Systems Division Dean	MIT
Webinar	19.07.2013	Student action for university community investment	
Interview	12.07.2013	Cliff Cook	Cambridge Community Development Department
Interview	12.07.2013	George Mokray	Solar IS Civil Defense
Interview	15.07.2013	Melvin H. King	MIT
Interview	20.07.2013	Caitria O'Neil	Recover.org
AOM Conference	10.08.2013	Prototyping workshop @ the AOM Orlando Florida	Academy of Management Conference
Future Cities and Transport Symposium	21.03.2014	Imperial College London	SSN+/NEMODE
Special issues	01.11.2014	Future Cities and Urban SCM	SCM: an International Journal

	24.02.2014	Future Cities And Strategy	Pending negotiations with Brian Silverman “Advances in Strategic Management”.

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