A TECHNOLOGY DEBATE ON UNIVERSAL TRANSPORTATION

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SUMMARY

Throughout history, humans have made use of innovative technologies to facilitate survival. Weapons were invented to hunt and for self-defence, utensils were designed to prepare meals, tools developed to build shelter, electricity invented to improve comfort and convenience, wheels to transport people and goods, safety belts to protect car passengers, wheelchairs and scooters to improve mobility for those who cannot walk, Talking Signs for people who cannot see, and telecommunication devices for those who cannot hear.

Over the past 25 years, great strides have been made in the application of advanced technologies to assist people with disabilities in their daily living, including making transportation universally accessible. However, questions must be raised as to what, when, where and how technology and innovation could be best employed in order to arrive at practical mobility solutions.

Using accessible transportation technologies as examples, this paper will discuss the following issues within the context of developments in wealthy and less-wealthy nations:

- Manual systems versus automation
- Technology-push versus demand-pull
- Technology leaps and product obsolescence
- Technology slavery versus improved level of service

Thus far, the "technology-push" phenomenon is mainly evident in wealthier and developed countries; whereas the unfulfilled "demand pull" is more prevalent in less wealthy nations. Technological innovations and product obsolescence go hand-in-hand, with affordability and sustainability as over-riding concerns. Carried to an extreme, technology could result in techno-slavery, with the disadvantages outweighing the improvements in level of service. Probably, the right mix of human

assistance and technologies would be required and considered within the overall cultural, economic and geographical context.

International experience will be identified and analysed along the above discussion threads. Hopefully this debate will result in a better understanding of the appropriate level of technology to be adopted in a universally accessible transportation system.

Introduction

There are a variety of public transportation modes, all with the same objective, to provide safe, reliable, and affordable means to move people from one point to another for short and long distances. To facilitate movement, technologies for vehicles, terminals, stations, stops, communication and information systems have been developed, along with the assistance provided by carrier personnel.

To make transportation accessible to those with mobility and sensory impairments, wealthy countries have adopted legislation (USA and Europe), voluntary codes of practices (Canada, Australia), paratransit systems, and made accessible transportation mainstream. Advanced technologies have been developed to overcome barriers. Accessibility in wealthy countries appears to be driven by technology-push within the context of a policy and legislative framework.

Examples for personal mobility technologies include sonic canes for people who are blind, electric scooters for people with mobility impairments, and voice-to-text systems for those who are deaf. Examples for transportation accessibility include low floor buses, visual messaging systems in airports and door-to-door special transit.

Some less-wealthy countries have relied more on labour-intensive solutions for mobility and accessibility, ad-hoc implementation of solutions, privately sponsored door-to-door transport for disabled, with accessible mainstream transportation in its infancies (Rickert, 2001).

Examples for personal mobility technologies include customized wooden platforms to be pulled/pushed in lieu of wheelchairs and scooters, and customized push cycles. Some countries still rely on the horse-drawn cart, the cycle-rickshaw, and human powered tricycles adapted to accommodate wheelchairs (Sen, 2001).

Yet other less wealthy countries have also taken a leap forward to address the ever-increasing demands for accessible transportation, e.g. the implementation of low floor buses in Buenos Aires, Bus Rapid Transit vehicles in Curitiba, Brazil, and subway stations with easy access features for users of wheelchairs and travellers with visual impairments in South America, Mexico City and Hong Kong. Despite these improvements, the average person with disabilities living in urban and rural environments still lacks access to even basic public transportation.

Purpose and Approach

The purpose of this debate is to present the pros and cons of technology issues within the context of developments in wealthy and less-wealthy countries for universally accessible public transportation systems. These systems consist of products, services and procedures designed for all people, without segregated treatment for groups with special needs.

The information presented in this paper is based on publications, reports, the Internet, and library material (both published and in ICAT's private collection) pertaining to topics of this debate. Keywords used included, technology, automation, obsolescence, universal design and sustainability. The pros and cons of each of the following four issues will be presented with examples. The authors will attempt to draw some conclusions out of the debate at the end of this paper.

1. Manual Systems versus Automation

Manual systems rely mainly on human labour or manually operated mechanical systems to facilitate accessibility in travel. An example is the transfer of a passenger in a wheelchair from a terminal to an aircraft, performed manually by several airline personnel. Manually lifting, or a mechanical lift operated manually, is also used to board the passenger from a platform to a railcar.

Automated systems rely mainly on technology to achieve the same goal. Using the same example above, a powered lift, or a low-level loading bridge (See Figure 1) would be used for the passenger in a wheelchair to board an aircraft. To board a train, a built-in combined stair-lift to board passengers in wheelchairs would be used, all systems being controlled by one operator.

The question is: How much technology do we need or can we afford?

The argument for manual systems is that they can always be tailor-made to the needs of the individual and are therefore flexible. Decisions can be made immediately as required, but the process may not always be safe and dignified for the user. This approach can be expensive in wealthy nations where labour is costly, but reasonable in less wealthy countries where labour is abundant.

The argument for automation is that it is efficient. It can be more cost-effective in some situations in wealthy nations by reducing the number of personnel for the task. However, when automation takes decision-making out of the system, especially when there are too many variables involved, it may not work properly. For example, computerized dispatch systems for paratransit are still unable to respond on demand in real-time. The advance one-day notice required is inconvenient for users and results in no-shows. Another disadvantage of automation is its lack of adaptability to the needs of individuals, and it may not be affordable for less wealthy countries.

In wealthy countries, the automated solution is preferred and is more available due to technological advances and lack of cheap labour. Manual lifting and manual or animal-powered vehicles are often the mobility solutions for less wealthy nations. For the user, both approaches have pros and cons. The automated system is reasonably

safe, dignified and efficient, as long as it is reliable and functional, but is costly (Lewis, 2003). The manual system is functional and affordable in countries with low labour rates, but carries the risk of injuries for both passenger and agents, and is less dignified. It must be emphasized here that both automated systems and manual systems require training. With rapidly expanding global travel, the passenger may be faced with a variety of solutions, which carry different levels of technologies, dignity and risks (see Fig. 2).

2. Technology-Push versus Demand-Pull

Technology push is defined as identifying or creating a new technology without having a market defined, and then finding or creating a market (Ghahramani, 2003). It is based on the premise that technologies will provide the solution to improve services and a better life style, but with an unknown market. A typical example for a technology in search of a market is the development of a hand- held navigator using GPS for people who are blind or elderly and who would like to find their way without the assistance of other persons to get from home to a bus stop (Tajima, 2004). This approach is often seen in wealthy countries, which have an abundance of knowledge, material and capital resources.

Demand-pull is defined as identifying a market and then creating a new technology or product that meets the need of the market (Ghahramani, 2003). Less-wealthy countries with a rapidly increasing population face a demand disproportionate to their ability to supply the needed goods and services. An example of demand-pull is the development of low floor technologies to address the market need for reduced bus dwell times to accommodate passengers with restricted mobility within the context of the enormous passenger demand. This is mostly seen in countries with a limited knowledge base, scarce resources and materials, and little capital.

The advantage of a technology-push strategy is its ability to anticipate needs. It is able to render a fast and immediate response to the market especially in times of crisis. The resultant knowledge base and critical mass serve as building blocks for the future in addition to generating its own demand for product and services. On the other hand, it entails high financial risks if the market does not materialize; thus rendering the high development cost unrecoverable.

The strength for the demand-pull strategy is the certainty of an available market ready for implementation and commercialization. The risk for the development of products or systems is usually low. The weakness lies in the constant need to catch up, resulting in long waiting periods for the technology to mature. This approach is unable to respond to the immediate needs of the market.

At what point should countries use their resources to anticipate the demand and develop new products? How is the right balance is struck between technology-push and demand-pull in universally accessible transportation?

The push for too much technology can lead to over-dependence and the belief that technology holds the answer to all problems. An economy with heavy emphasis on technology-push can run up against the danger of planned obsolescence (see Item 3 below) in order to sustain its viability and vitality. No matter how many technologies

are developed and applied, personal intervention or interaction, especially in transportation and for passengers who require special care, will be needed. The application of appropriate technology, coupled with human touch, should be the best path to follow.

3. Technology Leaps and Product Obsolescence

Technology leap is defined as the process of accepting state-of-the-art products or systems without going through the research and development process before implementation. These quantum jumps typically occur in less wealthy countries which adopt new technologies from wealthy countries without having to develop them and without having to go through the teething process themselves.

When a technology reaches a state where it is no longer useful and is superseded by better technology or upgrades in order to continue to function correctly, obsolescence is the result (Gylfason, 2001). The continuing development of new technologies in wealthy countries brings with it obsolescence, often planned and artificial in nature.

In developing new technologies, a scientific knowledge base, management skills and skilled labour pool are the corollary products. For example, in accessible urban bus development, initially high floor buses were retrofitted with lifts and forward facing wheelchair securements, and the design eventually evolved into low floor design, incorporating rear-facing wheelchair systems from the outset (Rutenberg, 2003). The superior universal design, user acceptance and commercial availability of the low floor bus render the older technology of lift-equipped buses obsolete.

Less wealthy countries often can ill afford the research and development stages due to resource constraints. They usually resort to adopting state-of-the-art technologies from wealthy countries with insufficient knowledge and training. It is a fact that the front ends of low floor buses have been frequently damaged because the drivers were not trained to operating low vehicles in an environment of high curbs and incompatible pavement infrastructure.

Another innovative technology, such as the cellular phone, has been developed for well over two decades, but the adoption rate is somewhat faster in the less wealthy nations. They have become tremendously popular in less wealthy nations, not only as a communication device and as personal mobility planner, but also as a standby safety and security assistant.

Embracing a new technology developed elsewhere is less risky then developing indigenous new products and systems. The positive aspect is the openness to change and willingness to experiment with new products and services. However, the learning curve is steep, the experience to manage the technology is sparse, and the risk of sustainability is high. The technology might be adopted simply as a status symbol rather than real need. This approach reinforces dependency on the technology from developed countries.

The introduction of new technologies to the market is costly and its rate of adoption can vary from a few years to a decade or longer. Once consumers start responding, the effective life span of the product can be quickly determined. If the level of service

offered were not perceived to be significantly better than present solutions, the product would have a relatively short life span (see Fig. 3).

Technological innovations and product obsolescence go hand-in-hand, with affordability and sustainability as over-riding concerns. As developing countries are observing the emergence of these technologies, they must be clear on what governs technology adoption for making transportation accessible. Time-honoured and successful solutions proven in other countries may be the key factors in determining if a leap is warranted.

Wealthy countries must be aware of the conflict between developing new technologies and obsolescence. The push for new technologies carries the risk of obsolescence the leap for new technologies may trade-off service level with gadgetry.

4. Techno-Slavery versus Improved Level of Service

One of the purposes of developing new technologies should be to improve the level of service, quality of life, safety, reliability and affordability in public transportation for all users, including those with mobility and sensory impairments. If the push for new technologies is carried to the extreme, it can result in techno slavery, the complete subservience and total dependence on a given technology to the exclusion of other factors, resulting in an undesirable change in life style and societal values. For cell phone users, "late has no meaning" because one can provide frequent real-time updates of the arrival situation due to heavy traffic or other factors (Gazette, 2003).

A typical example of techno-slavery today is someone equipped with a cell-phone, a pager, a home computer, a laptop, a home fax machine, a palmtop, and a pocket PC, all for one purpose: to be available and reachable 24 hours in any location away from his/her office or home. The nine-to-five hours at the office have now been extended to five-to-nine everywhere.

On the one hand, there are innovative products and systems that definitely improve the quality and level of service; and indeed, a user's life is never the same after its introduction. The availability and flexibility of a Blackberry wireless device (see Figure 4) enhances the mobility and safety of users with special needs in particular for those who are deaf. They can improve information accessibility of the user by accessing real-time vehicle location and coordinates, as well as communicating help messages, including SOS/911 in text mode. For people who are blind, text-to-voice systems are indispensable for similar applications.

Techno-slavery may have a temporary detrimental effect on the life of the user who might be overwhelmed by having to rely on so many different devices, e.g. a visually impaired traveller holding a sonic cane, also equipped with a cellular phone, a Blackberry wireless device and a Talking Sign receiver all at once. The desirable outcome under such scenario may be an "all-in-one" wireless communication device. In the context of mobility and accessible transportation, some communication technologies such as e-commerce, video-phones etc. may create a virtual mobility that can in theory result in a reduced demand for real travel. However, the price of reduced trip-making could mean that the user must constantly update his computer with newer and powerful hardware and software.

Conclusions

The debate on technologies for universal transportation seems to raise more questions than providing answers. One aspect is certain: there are no ready-made recipes. Is it techno-slavery, improvement of service, or gadgetry? All progress comes with a price attached.

Technological advance is inevitable as society progresses. Technologies are here to stay but we must harness them to serve us better.

In operating a transport system, pushing for new technologies (e.g., new fuels, hybrid technologies, low-floor vehicles, Intelligent Transport Systems) may render the traditional model of investment for amortization in vehicle technology, information, communication, and control systems obsolete.

The future challenge for wealthy countries is to establish a technological development framework to enhance universal accessibility while avoiding the pitfalls of obsolescence and techno-slavery.

The challenge to less wealthy nations is to determine the lifespan of innovative technologies, which must be addressed when transferring such technologies from other countries. Time honoured and proven solutions may well be the deciding factors to warrant the leap forward.

Technology is not the answer to all problems, especially for travellers who have physical, sensory and cognitive impairments. We must bear in mind that the human touch is paramount. To strike the right balance between the use of technology and human assistance is a challenge for those who provide universal transportation for all.

Fig. 1 Low Loading Bridge for Small Aircraft

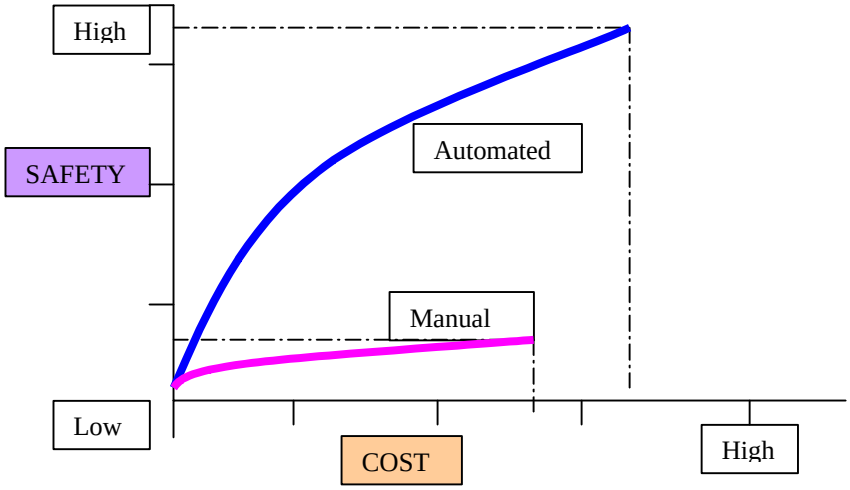

Fig. 2 Automated versus Manual Systems in Terms of Safety and Cost

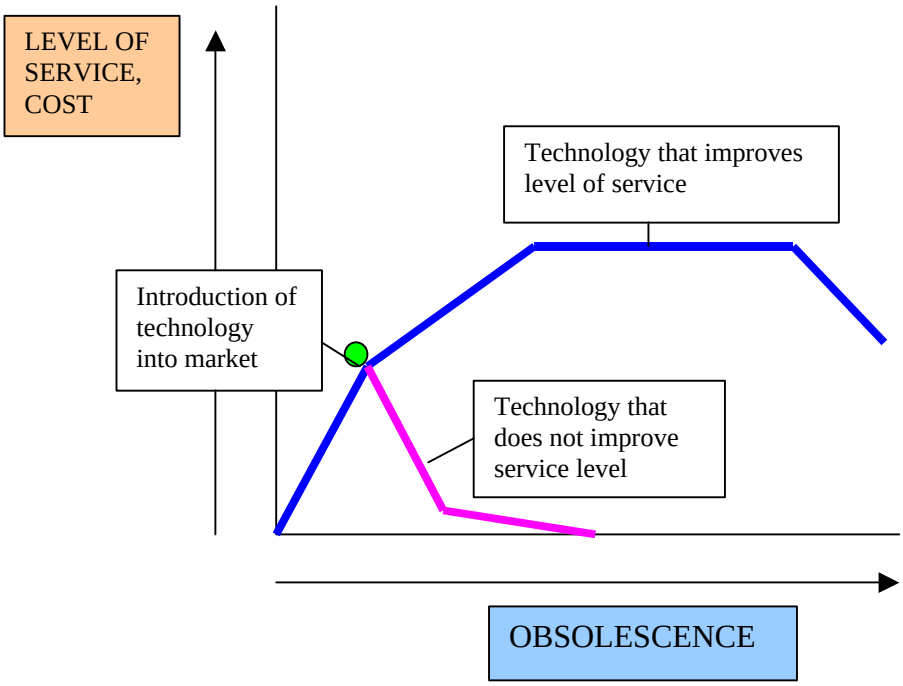

Fig. 3 Technology Effectiveness versus Obsolescence

Fig. 4 Blackberry Wireless Communication Device

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