URBAN GONDOLAS, AERIAL ROPEWAYS AND PUBLIC TRANSPORTATION: PAST MISTAKES & FUTURE STRATEGIES

RYAN O'CONNOR AND STEVEN DALE

1 ABSTRACT

Ropeways have long been used to traverse many of the earth's most challenging topographical landscapes. Hundreds of years of engineering innovation have progressed cable technology to an exciting point in its legacy — the urban public transport (UPT) market. 'Cable-propelled transit' (CPT), in particular the use of detachable aerial ropeways (hereafter referred to as 'urban gondolas'), is no longer a niche public transportation technology. Rather, CPT now competes with (and in some cases exceeds) the performance characteristics of other more common urban transport technologies.

The efficient movement of city dwellers through urban areas is a fundamental requirement for achieving sustainable development. For the ropeway industry to continue advancing into the urban market, a 'one size fits all' approach will not strike accord with politicians, urban professionals or the public. Transplanting 'alpine style' systems into urban settings as public transportation is not a realistic proposition for the future. Instead, a significant shift in thinking will be required to better market and adapt cable transport technology for cities, eventually fostering its use as a mainstream transportation option.

This paper approaches the issue from the perspective of two urban planners. It provides their subjective assessment of the current UPT market followed by a critical analysis of 'industry specific' hurdles that could be addressed to aid in the acceptance and implementation of urban gondola technologies. Finally, a number of solutions are offered that can help establish a framework of sustainable implementation strategies to ensure a strong and successful future for cable in the urban market place.

2 AUTHOR PROFILES

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3 INTRODUCTION

Today more cable propelled transit systems are being installed in the urban environment than ever before. If the numbers are increasing why change the current strategy? The answer lies at the core of this paper. Between 1980 and 1998, several papers were presented at the International Organization for Transportation by Rope (O.I.T.A.F.) congresses regarding the potential for urban gondolas in the UPT market. Many of the lessons presented in those studies have since been neglected. This was not a major problem during the last two decades as no discernible market for urban gondolas existed.

FIGURE 3.1: THE IMAGE TO THE LEFT IS A BRUSH DRAWING OF A PRIMITIVE AERIAL ROPEWAY DATING BACK TO 250 BC (HOFFMANN, 2006). THE IMAGE TO THE RIGHT IS THE WORLD'S FIRST FULLY INTEGRATED UPT GONDOLA SYSTEM (FIRST LINE BUILT IN 2004) IN MEDELLIN, COLUMBIA (DALE, 2010).

However, since the implementation of the world's first 'true' urban gondola in Medellín, Columbia in 2004, the market has experienced greater interest and growth. The fact is that although the technology's potential has been

demonstrated and documented, urban gondolas remain a fringe alternative in much of the urban public transport (UPT) market. Drawing from past experiences, it will take a combination of future strategies and innovative adaptations to the technology and marketing approach to realize the immense opportunities that lie ahead.

This paper, which has been prepared for the 10th Congress for O.I.T.A.F. in Rio de Janeiro, Brazil in 2011, begins with a broad overview and literature review of the current UPT market. Next is a critical analysis of what the authors believe to be the three major cable 'industry specific' hurdles that must be overcome in order to achieve sustainable growth in the UPT market. A number of potential solutions are highlighted, setting the framework for these future implementation strategies (hereafter referred to as 'strategies').

3.1 SCOPE OF PAPER

This paper is written from the perspective of two urban planning professionals based on their last three years working with a technology and industry that has limited experience in the urban context. It is an admittedly subjective account on the current situation and future possibilities.

Given that a body of research has already been developed on the benefits and limitations of urban gondolas as UPT, this report does not explore those issues. Instead it provides research and insight into the actual implementation from an urban planning perspective, offering 'industry specific' strategies for better realizing market opportunities. To date, little research has been undertaken on these matters.

3.2 ABBREVIATIONS

The following abbreviations are used throughout this paper:

- **BRT** - bus rapid transit
- **CPT** - cable-propelled transit
- **HSR -** high speed rail
- **LRT -** light rail transit
- **TW** - tourist / winter
- **UPT** - urban public transport

4 OVERVIEW AND LITERATURE REVIEW

This section provides an overview of urban gondolas and the UPT market. Appropriate background information is also included.

4.1 NO NEW IDEA

Installing gondolas in urban settings as UPT is not a new idea. A number of academics and industry professionals (to varying degrees) have discussed and/or advocated the merits of urban gondolas for public transport within cities (Bondana & Neumann, 1988 & 1989; McLennan, 1998; Neumann, 1992, 1994 & 1998; Hoffmann & Liehl, 2005; Fletcher, 2005; Hoffmann, 2006; Alshalafah & Shalaby, 2010). Already the industry has made significant advances in the performance and capabilities of the technology since many of these earlier studies; these include the tricable configuration, faster line speeds and standardized intermediate and turning stations.

So why after 20+ years is cable technology still not considered a mainstream urban transport solution?

4.2 MEASURING SUCCESS

For decades the industry has enjoyed dominance in the tourist / winter (TW) market. However, the transition into the UPT market has not had the same success. But how do you measure success? Yes, the industry is selling more ropeways to the urban market than ever before. Yet, the authors would argue that urban gondolas are underutilized in the UPT market considering the performance/cost attributes of the technology and the increasing demand for public transport solutions worldwide.

Success should be measured against the market opportunities that exist as opposed to moderate increases in sales volume.

4.3 UPT MARKETING CHARACTERISTICS

In the TW market, ropeway technology is often the only transportation option available and purchasers have been for the majority within the private sector. In other words, it is a relatively simple procurement procedure. In contrast, the UPT market is significantly larger and involves competing technologies, public sector involvement, politically driven motivations and timeframes, complex approval processes, urban design considerations, transport integration issues, and different customer expectations, among other obstacles.

Different issues exist; thus different strategies are required to better capture the opportunities presented by the urban market.

4.4 UNDERREPRESENTED TRANSPORT SOLUTION

Despite the performance / cost attributes of urban gondolas, the technology is often not even considered in transport alternatives analysis — the first stage of UPT technology selection. While engineering innovations can better adapt the technology for UPT, the authors believe this lack of representation is primarily due to a 'disconnect' and misunderstanding between both the urban market and the manufacturers.

Remediable steps could be undertaken by the industry and the market to ensure that ropeway technologies are not ignored in the selection process of UPT technologies.

4.5 URBAN TRENDS

In 1900, 13% of the world's population lived in urban areas (as opposed to rural areas.) This figure more than doubled by 1950 and in 2009, for the first time in history more than half of the world's population was living in urban settlements. At this rate by 2050 the urban population could be as high as 69%, with the vast majority of this growth occurring in developing countries (United Nations, 2005 & 2010).

Urbanization is linked to economic development and industrialization. To remain economically competitive, cities are investing heavily in transport infrastructure which in turn facilitates the efficient movement of people and goods (Tongji University, 2008).

The ever increasing demand for viable transport infrastructure creates favorable prospects for the UPT market and urban gondolas.

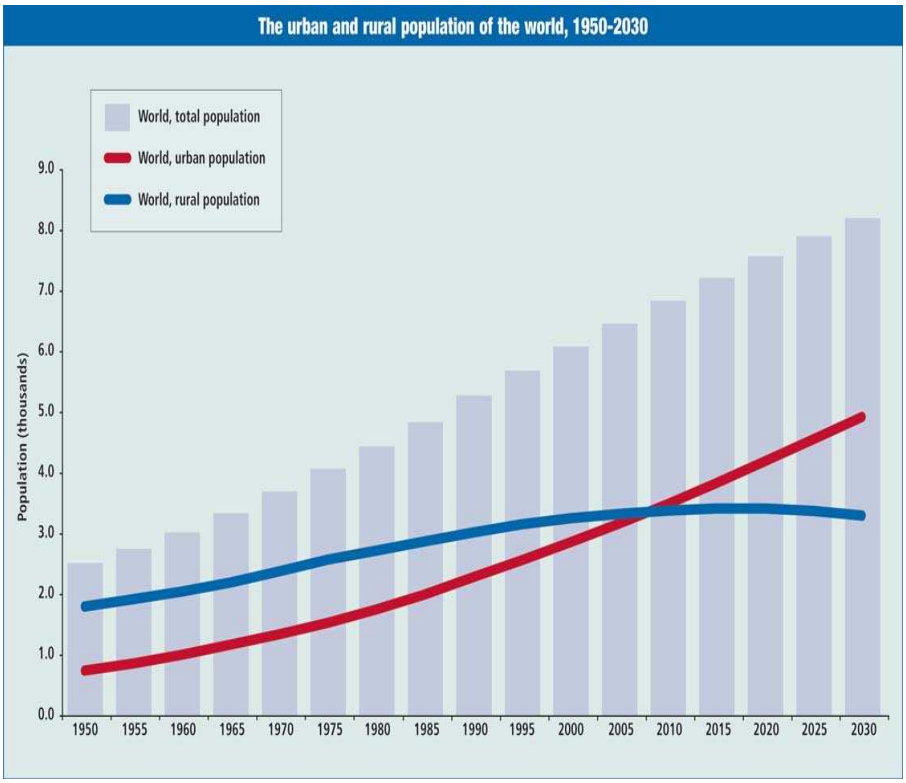

FIGURE 4.1: WORLD / URBAN / RURAL POPULATION (UNITED NATIONS, 2005)

4.6 TRANSPORTATION PROBLEMS AND THE PT RENAISSANCE

Urbanization inevitably leads to further economic, social and environmental problems, especially in developing countries. Transportation often further compounds such problems, contributing to:

- Heightened air pollution and associated health and environmental issues.
- Lack of access to employment and business opportunities.
- Lack of access to social, political and community services and facilities.
- Inefficient movement of goods and services, hindering economic development.
- Fatalities and injuries associated with transportation.
- High private and public costs of vehicle transportation and energy price fluctuations.

But as history demonstrates, problems and challenges lead to new solutions, and with these solutions come new markets and business opportunities. The factors noted in the bullets above have already begun initiating a public transport renaissance. LRT has fielded considerable interest despite its high per kilometer cost. BRT has also experienced exceptional growth in both the

developed and developing world. Even CPT has begun to make its way onto the UPT radar. As road and parking infrastructure continues to occupy increasingly valuable prime urban space, the benefits of UPT infrastructure over private vehicle infrastructure will become more and more apparent.

A number of factors favor UPT infrastructure over automobile infrastructure in cities.

4.7 MOBILITY BENEFITS AND CITIES

Mobility is the ability to move people and goods. Providing efficient mobility options dramatically increases 'quality of life' for urban inhabitants. Public transport systems can enhance mobility on a large scale, and if implemented correctly, have economic, social and environmental benefits, including:

- ***Economic*** - cost effective transportation, localized land development and spurred economic development.
- ***Social*** - social inclusion and accessibility to amenities, education and work opportunities.
- ***Environmental*** – reduced energy consumption, greenhouse gas emissions, air pollution and minimal disturbance to urban fabric.

While mobility is a simple concept, its implementation is not. A holistic understanding of urban transport aids in communicating the benefits of gondola technologies to the UPT market.

4.8 URBAN FORM AS A TOPOGRAPHICAL CHALLENGE

Modern day ropeway systems have for the most part existed, thrived and developed on the sides of steep mountains. This association is both helpful and potentially detrimental to the adaption of cable into the UPT market. The characteristics that allow gondolas to overcome difficult natural terrain also allow them to circumvent challenges that can exist within the 'urban form'. Urban form refers to the physical layout of a city and takes into consideration density, street layout, traffic patterns, transportation options, land uses and urban design issues. To varying degrees, mobility is constricted by the urban form in many cities.

Unplanned urban growth is characteristic of many developing world cities and results in inefficient and impassable transport routes. Streets are often narrow and winding, and in some cases dominated by unregulated uses (i.e. street traders) making travel speeds often painstakingly slow and causing populations to become 'mobility-deprived'.

'At grade' rapid transport modes (i.e. BRT and street-level rail systems) become impractical and uneconomic due to lack of space and difficulties of implementation — property acquisition tends to inflate costs dramatically and is politically challenging. On the other hand, urban gondolas are not adversely constrained by urban form and require minimal property acquisition. Mobility is enhanced where other technologies are unworkable at street-level.

Significant market opportunities exist for urban gondolas in many dense urban environments.

4.9 MARKET GROWTH

The authors believe the UPT market will become the dominant market for the cable industry in the future. Today there are already UPT systems operating in the United States, Algeria, Spain, China, and Brazil with 'high profile' systems proposed in both Britain and Canada. Research undertaken by Creative Urban Projects in 2010 found that there are 57 systems currently proposed or under construction in South America alone (excluding Brazil). Cities around the globe are beginning to realize the potential for urban gondolas as part of a solution to their mobility needs.

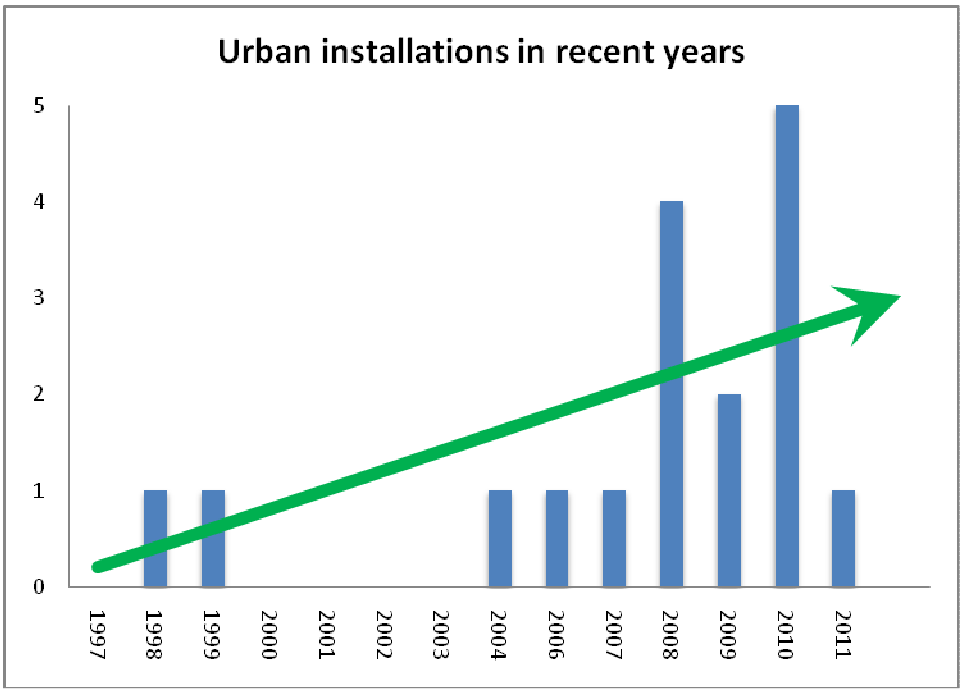

FIGURE 4.2: THIS GRAPH DEMONSTRATES THE GROWTH OF URBAN AERIAL ROPEWAYS COMMISSIONED IN RECENT YEARS. IT IS NOT STRICTLY SPECIFIC TO UPT SYSTEMS, BUT ALSO INCLUDES TOURIST SYSTEMS IN URBAN SETTINGS. SINCE 2004, TEN AERIAL ROPEWAYS HAVE BEEN COMMISSIONED PRIMARILY FOR UPT PURPOSES. SPECIFIC SYSTEMS AND PROPOSED SYSTEMS ARE DETAILED IN TABLE 9.1.

4.10 INDUSTRY POSITIONING / RISKS

Today two companies — Doppelmayr/Garaventa Group and Leitner Ropeways — dominate the international ropeway market. This dominance is partly secured by existing intellectual property, technical capability and manufacturing capacity. Therefore the authors believe that both are well placed to capture the UPT market.

However this is no reason to be complacent. High-speed rail (HSR) manufacturers Siemens, Bombardier and Kawasaki recently discovered that patents and technical capability alone do not guarantee market security[1] (Wall Street Journal, 2010).

While the existing ropeway manufacturers are favorably placed to serve the urban market, considerable investment and proactive strategies are required to ensure this positioning translates into future success.

4.11 SECTION SUMMARY

Installing urban gondolas as UPT is not a new idea. While the industry is selling more ropeways to the urban market than ever before success should be measured against the market opportunities that exist as opposed to moderate increases in sales volume.

Urban gondolas are competing with, and in some cases exceeding the performance characteristics of traditional UPT technologies. However, cable technology is often excluded from transport analysis. Remediable steps could be undertaken by the industry and the market to ensure that ropeway technologies are not ignored in the selection process of UPT technologies.

The UPT market is significantly different from the TW market; thus new strategies are required to better realize market opportunities.

With increased urbanization comes the ever increasing demand for viable transport infrastructure. This creates favorable prospects for the UPT market and urban gondolas.

The authors believe the UPT market will become the dominant market for the cable industry in the future as cities around the globe are beginning to realize the potential for urban gondolas as part of a solution to their mobility needs.

[1] This point is discussed in a later section (Section 5.3).

The industry is well placed to capitalize on future growth; however it could benefit from being more proactive and strategic in ensuring favorable positioning that translates into future success in the UPT market.

5 PAST MISTAKES AND FUTURE SOLUTIONS

In this section the authors discuss and demonstrate how three core issues currently hinder industry reception into the UPT market. Potential solutions are offered to resolve each issue.

5.1 MISTAKE 1: ALLOWING INACCURATE INFORMATION TO FLOURISH AND THE "URBAN DISCONNECT"

Unlike the TW market where decisions to install and purchase ski lift systems lay almost exclusively in the hands of private sector decision-makers, public transport systems are typically procured by public sector transit agencies. Granted, the worldwide trend towards public-private partnerships (PPP's) has given the private sector more of a say in evaluating and consenting to infrastructure projects, public sector officials still have the dominant role in any UPT project.

With this dominant role comes great responsibility. Public sector agencies, tasked with managing and administering capital works projects involving billions of dollars of public monies, have a clear and demonstrable need for transparency and accountability. Transport agencies must therefore be able to articulate not merely *what* decisions they're making, but *why* they're making them.

While there is no point suggesting that a given agency's decision will always be clear, rational and independent of political interference, it is nevertheless important that these decisions be supported by as much independent — and ideally — peer-reviewed research as possible. In regards to urban gondolas that research is entirely lacking — a situation causing the technology to be often disregarded as an option.

This concept was highlighted explicitly in a 1988 O.I.T.A.F. Congress paper by Bondada & Neumann in which they quantify the perceptions transport planners have about a range of technologies — including aerial ropeway technologies. The findings indicate that the respondents' views of cable technology were characterized by misperceptions concerning capacity, availability, headway, speed, costs, procurement and implementation.

Bondada & Neumann discovered that "*aerial cable gondola technology was the least preferred"* amongst respondents yet *"planners and engineers with cable experience ranked cable technologies higher in preference than individuals without cable experience."* Compounding the problem, *"the majority of respondents"* had virtually no experience with the technology.

In a follow-up to their 1988 study, Bondada & Neumann were quick to observe that for their study's respondents *"the major source of knowledge on all the technologies is 'reading journals, magazines and other articles' about the technologies"* (1989). Unfortunately, journal and magazine profiles of cable technology were virtually non-existent at the time, a matter that has only recently begun to change.

The last comment notwithstanding, in early 2010 one of this paper's authors, Dale conducted a casual scan of 23 English language journals related to the field of urbanism and transport planning. That scan, while admittedly non-scientific and cursory, revealed only two mentions of cable technology over the past 20 years — an inconsequential mention of tramways in a 1996 issue of the Journal of Public Transportation, and an article entitled '*The Past, Present, and Future of Urban Cable Propelled People Movers'*, by Edward S. Neumann from a 1999 issue of the Journal of Advanced Transportation.

The need for more accurate and robust information applies not only to decision makers, but to the public and media that hold them accountable. Such accurate and robust information is still relatively non-existent.

For example: In mid 2011, the CTV news agency in Canada reported on a proposed urban gondola system in Calgary, Alberta. Not a single image of a built and realized urban gondola system was shown. Instead, images of aerial tram technology, futuristic 'concept' systems and a wholly inaccurate artistic rendering of an 'aerobus' were used. In this case a prime marketing opportunity for the industry and technology actually turned out to be both detrimental and counterproductive.

Figure 5.1: THESE IMAGES WERE USED TO EXPLAIN WHAT AN 'URBAN GONDOLA' IS ON CTV PRIME-TIME NEWS. LEFT IS THE OLD ROOSEVELT ISLAND TRAM, CENTER IS A CONCEPTUAL DUAL-LOOP MONOCABLE SYSTEM, RIGHT IS A 1960'S FUTURISTIC IMAGE OF AN 'AEROBUS'. SOURCE: CALGARY CTV, 2011.

What urban gondola research does exist is typically culled from compendiums of O.I.T.A.F. congresses. While the papers within compendiums are typically accurate and insightful, it is hard to argue that they are 'independent' sources of information. This so-called 'grey literature' combined with manufacturers' marketing material dominates the conversation about urban gondolas and leaves questions about the validity of the claims made within the documents.

The only other readily-accessible sources of independent research on urban gondolas are government studies and analyses. Unfortunately, while these sources may be considered independent, they tend not to be comprehensive or accurate. The two highest profile examples of such documents are the '*Ogden Urban Gondola/Tram Comparison'* and the '*Hercules Aerial Tram Study'*.

5.1.1 OGDEN, UTAH URBAN GONDOLA/TRAM COMPARISON

Created by city council staff in Ogden, Utah in 2006, this document was prepared *"as a tool to help provide the Council with information about other gondolas/trams"*. The purpose of the document was to compare and analyze seven different urban gondola systems and was created after a *'Transit Corridor Study'* recommended the use of streetcars in Ogden rather than gondolas. The report is publicly available on the internet and ranks high in search engine results.

The sources for the report are poor; tabloid-style newspapers such as *USA Today*, Wikipedia.org and private sector brochures are the main sources of research. No peer-reviewed or independently verifiable sources were used.

At the time of the document's writing, only three of the seven systems analyzed were actually in operation. Of the others, the Portland Aerial Tram was still under construction; the Mississippi Aerial Rapid Transit (M.A.R.T.) had been closed down and disassembled; and both the Baltimore Waterfront Tram and Philadelphia/Camden Skylink were mere concepts.

5.1.2 HERCULES AERIAL TRAM STUDY

Conducted by Reconnecting America for the city of Hercules, California in 2007, the '*Hercules Aerial Tram Study'* is comprehensive in that it accesses most of the available existing literature. Its analysis, however, is severely flawed due to three critical errors made by the study's authors:

1. Study authors appear to confuse aerial tram and detachable gondola technologies. Even the title of the study is incorrect as the study itself investigates detachable gondolas. Operating characteristics of the

different technologies are constantly and inconsistently conflated with one another.

2. Study authors rely solely on outdated literature and do not empirically examine new technologies or systems. This was a particularly egregious mistake as the Medellin Metrocable had been in operation since 2004 — three years prior to the study's publication.

3. Study authors imply that cable technology is inadequate by deeming innovations (such as angle stations and mid stations) as rare exceptions rather than as competencies and capabilities of the technology.

A sample of the inaccurate claims can be summarized by the following quotes which have been extracted from the study:

- *"Expandability is impossible or difficult or best"*
- *"...current technology makes it difficult to have systems consisting of more than two stations..."*
- *"...midway stations are very rare, and expansion is difficult."*
- *"Alignment tends to be limited to a straight line."*
- *"Availability, while high, is not as great as for other technologies."*
- *"System capacity upgrades will require reconstructing the entire system."*

5.1.3 WHY STUDIES LIKE THIS ARE A PROBLEM

The issue with literature such as the *'Ogden Tram Comparison'* and the *'Hercules Aerial Tram Study'* is that, for much of the last decade, these have been the only publicly available research documents on urban gondolas. The adverse effects these studies have had can only be speculated upon but were likely compounded by the recent rise of internet-based research and the documents' search engine dominance.

It is important to recognize that within government and planning research, a 'garbage in, garbage out' phenomenon occurs as others take available information as fact and propagate it throughout their own research — whether said research is factual or not. Research documents of a higher quality commissioned by government agencies and think tanks are either unavailable to the general public or are only released to the public well after their findings are current or relevant. Some notable examples include the *'Burnaby Mountain Gondola Transit Feasibility Study'* by Tupper (2009) and *'re-introducing Airtrams'* by Dale (2008).

High-quality research papers and documents such as the O.I.T.A.F. Congress compendiums, meanwhile, are still only available by order from the highly-specialized Arthur Lakes Library at the Colorado School of Mines — hardly the place an urban planner or transport engineer would think to look for research on urban public transport.

Incorrect and inadequate information increases the disconnect between the manufacturers and urban professionals. This lack of understanding of the technology by urban professionals is what the authors term the *"urban disconnect"*.

Bondada and Neumann (1988) highlighted this problem more than 20 years ago and little has changed. The technology has advanced significantly since the days of providing a *"low cost method of connecting two points in a straight alignment"* (ibid) yet even two decades later, cable technology fails to be considered in many a transport alternatives analysis. The *"urban disconnect"* still remains a significant obstacle to overcome in fully realizing the UPT market.

5.1.4 POTENTIAL SOLUTIONS

The authors highlight the following solutions to resolve the issues associated with the "urban disconnect" detailed in the previous section:

- Digitize and host online all O.I.T.A.F. papers dealing specifically with the concept of aerial ropeway technology as mass urban public transport. Make these papers and reports free and simple to download (preferably from an independent source).
- Participate in the research process. Fund or assist in high-quality research and ensure that these findings are spread throughout the urban/transport planning community.
- Promote the successes of UPT systems and make information on them publicly available.
- Employ search engine optimization (SEO) specialists to interrupt the flow of inaccurate research about cable technology and highlight accurate information on the internet.
- Ensure all significant languages have adequate accessibility to high-quality research.
- Encourage standardized terminology in industry/company policy.
- Expand the "grey literature" base (i.e. technical reports from government agencies or scientific research groups, working papers from research groups or committees, white papers, or preprints).

5.2 MISTAKE 2: OPPORTUNITY COST OF CHASING THE WRONG INSTALLATION

As discussed previously, procurement in the UPT market is significantly more complex than in the TW market. This makes opening, qualifying and closing sales leads demanding and costly. Aggressively pursuing the 'wrong' installations can be an expensive and risky endeavor as so many factors are involved in the urban sales process.

Primary among these factors is the sheer number of stakeholders and decision-makers involved in the UPT market combined with the length of the sales cycle — conception to realization takes considerably more time within the urban market thereby increasing costs[2]. As the UPT market grows, manufacturers should attempt to not waste resources on 'dead end' projects as promising and politically feasible projects could be neglected.

With growth in the urban market coupled with the number of stakeholders involved in any project, manufacturers should expect to field considerably more queries for potential installations. To fully capture this growth in interest and translate it into success, the industry needs to be 'smarter' in qualifying and prioritizing its resources to installations that are most likely to succeed.

In the past, chasing after the wrong urban installations has been wasteful and potentially damaging to the reputation of the manufacturers and technology. Notable North American cases of failed systems/proposals include:

- M.A.R.T - New Orleans, United States
- Ogden Urban Gondola - Ogden, United States
- Harbor Gondola - Baltimore, United States
- Montréal Telécabine - Montreal, Canada
- Freedom Gondola - Detroit, United States and Windsor, Canada
- Skylink - Camden / Philadelphia, United States

M.A.R.T. was actually built, but ceased operations in as little as one year due to bankruptcy. When it was constructed, it was touted as the *"transit system of tomorrow"* (Lewiston Journal, 1984). Foundations for the Camden/Philadelphia Skylink, meanwhile, were also constructed but work stopped there. The other systems never made it past the feasibility study level. What costs were incurred by the cable industry developing these projects?

[2] The Portland Aerial Tram was originally imagined as far back as 1999 and would not actually open to the public until 2007 (although this only explains part of the extra costs incurred.)

Due to language constraints, North American concepts/proposals are disproportionately represented here but anecdotal evidence suggests such failed urban installations are not uncommon throughout the developed world. Maybe more worthy of contemplation are not the failed attempts to build urban gondolas we know about, but the failed attempts to build urban gondolas *we don't know about.*

The salespeople representing the manufacturers have clearly been a part of the cable industry's successes within the TW market. However, one needs to question whether the techniques and tactics used in the TW market are suitable for the UPT market.

Common to all the failed proposals listed above (with the possible exception of the Ogden Gondola) is a specific focus on the tourism market in the urban environment. Yet despite repeated failures at tourist-oriented urban gondolas in a North American context, the proposals continue unabated.

Very recent initiatives for gondolas in urban North America such as those in St. Louis, Ocean City, Atlantic City and Long Beach all share the same tourist-based theme and it is the authors' opinion that all four are likely to suffer the same fate as those before them[3]

One must therefore ask if the existing sales model is too tourist-oriented to be sufficiently effective for the urban public transit market.

Understanding the fundamentals of any given urban environment will help address these questions. This means appropriate education, proper due diligence and project vetting with the right advisers. These initial steps may incur short term costs, but those costs are a fraction of actual and opportunity costs incurred by chasing after installations that have little hope of ever being realized. Similarly, short-lived systems can end up damaging the reputation of both the technology and the manufacturers.

5.2.1 POTENTIAL SOLUTIONS

The authors highlight the following solutions to resolve the issues associated with qualifying sales leads detailed in the previous section:

- Use education and due diligence processes as a tool to identify and prioritize sound urban gondola opportunities while ignoring those unlikely to be realized.

[3] The authors acknowledge that urban gondola systems tailored to the tourist market do have a history of success outside of North America. The reason for this divergence of experience is not well-understood and would be worthy of further study.

- Avoid being swayed by the potential opportunity *any* urban application represents. A significant portion of urban transit proposals are never actually realized despite significant funds being committed to them. Learn to spot the strong proposals from the weak and dedicate resources appropriately.
- Undertake a critical appraisal on whether the existing sales model is sufficiently equipped for the UPT market or whether changes are required.
- Consider educating salespeople in basic urban and public transit fundamentals *and/or* providing suitable advisers to assist salespeople from the very beginning of prospective projects, *and/or* establishing specialist UPT sales bodies.
- Price urban installations accordingly to include the costs of due diligence and heightened market risk.

5.3 MISTAKE 2: RESISTANCE TO CHANGE AND RISK OF COMPLACENCY

In 1995 Harvard Business School Professors Clayton Christensen and Joseph Bower developed the concept of '*disruptive technologies'.* The concept can be summarized easily from their Harvard Business Review paper *'Disruptive Technologies: Catching the Wave'*:

> *"the processes and incentives that companies use to keep focused on their main customers work so well that they blind those companies to important new technologies in emerging markets. Many companies have learned the hard way the perils of ignoring new technologies that do not initially meet the needs of mainstream customers."*

Using example after example, Bower and Christensen make a compelling case that, while it is important to listen closely to a company's core customers (in this case the TW market), it is essential that companies not ignore potential disruptive innovations that have the ability to change entire industries (in this case the UPT market). It is the authors' opinion that ropeway technology is currently acting as a *'disruptive technology'* to the standard UPT market while continuing to be a '*sustaining technology*' [4] within the ropeway industry itself.

[4] Bower and Christensen define *'sustaining technologies'* as those that *"tend to maintain a rate of improvements"*; that is, they give customers something more or better in the attributes they already value.

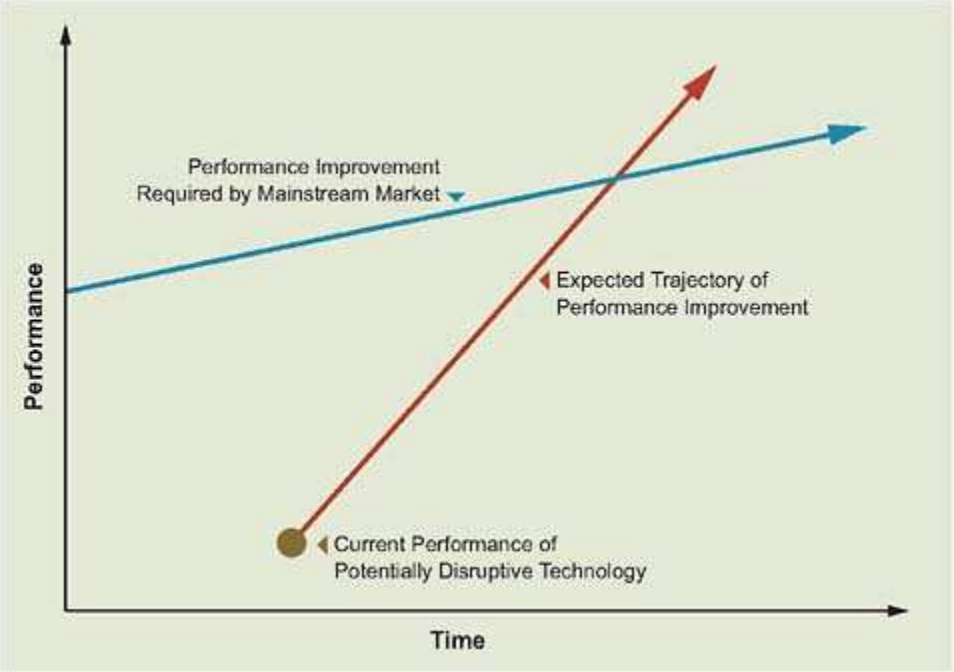

FIGURE 5.2: MARKET PERFORMANCE OVER TIME. SOURCE: THE NATIONAL ACADEMIC PRESS, 2011 FROM BOWER AND CHRISTENSEN, 1995.

To date the industry has proven adept at sustainable technological innovation — especially where profound environmental constraints have been present. The invention of the tricable configuration allows for massively increased spans with the added benefits of increased capacity, speed and wind stability; heating and cooling systems were added to address temperature fluctuations; and safety features and processes have been developed to enhance passenger safety and allow for in-station rescues.

In other words, the manufacturers have responded to external challenges with continual innovation. Yet most of these innovations have been what Bower & Christensen would describe as being of a *sustainable* variety. That is, they've improved gradually and sustainably in order to provide for the growing needs of the existing TW market.

The UPT market has benefited too from these *'sustaining innovations'*, however not to the extent one might think. After all, systems like the Medellin Metrocable and Caracas Metrocable utilize standardized cable industry technologies with little innovation specific to the urban market.

Unique problems still exist for ropeways within the UPT market and disruptive innovations specific to the urban environment are few. From an outsider's perspective the industry appears to be cautious in undertaking innovations for

this market. This concern is understandable but does endanger all the positive developments the industry has recently experienced in the UPT market.

In the authors' view, the following characteristics currently prevent the technology from growing rapidly within the UPT market:

- Average line speeds are currently competitive with many standard forms of mass public transit in a variety of situations. Average line speeds are not, however, competitive in long-distance alignments lacking intermediate terminals.
- Dwell times for urban gondolas are unacceptably long. Given the fact that high-capacity metro lines can operate with dwell times of less than 20 seconds, there is no compelling argument for why an urban gondola must operate with dwell times of 30-60 seconds.
- Urban gondolas require greater design and architectural considerations than current best practices in transit planning allow for. Transplanting 'ski hill' style gondolas into urban areas may not be ideal for many cities.
- Similar to any public transportation mode, the option of including heating and cooling equipment is a necessity though there still lacks a clear consensus on what the cable industry can and cannot do with heating and cooling systems for UPT systems.
- Stations could benefit from a reduced footprint. Elevated of 'slim profile' stations could fit more easily within existing transport corridors reducing implementation costs and transport interference at the street level.
- Noise and privacy issues are likely to gain greater attention as the technology becomes increasingly noticed by those in the developed world.

Much of the UPT research and development to date has been directed towards innovations of 'bottom supported' systems such as Poma-Leitner's MiniMetro and Doppelmayr's Cable Liner technologies. Meanwhile, R&D for 'top supported' detachable gondolas in the UPT market appears to have taken on a lesser priority.

Cable-drawn bottom supported systems have a number of benefits over their self-propelled competitors in certain circumstances (Neumann, 1994) but they have yet to find mainstream acceptance as mass public transit. Today these bottom-supported ropeway technologies appear designed to best mimic urban public transit. Taking on such roles as airport people movers, the market has positioned bottom supported technologies as a way into the urban market. Yet

these systems are not proving as successful as urban gondolas and aerial ropeways — technologies designed explicitly for non-public transit markets.

Disruptive technologies tend to thrive in high growth markets where owners of existing technologies are slow to innovate — at least beyond the pace set by those *sustainable innovations* demanded by a pre-existing customer base. As the UPT market grows for ropeway technology, executives would be wise to recognize that if the industry doesn't innovate *specifically for* the UPT market, other companies will.

5.3.1 THE CASE OF HIGH SPEED RAIL INNOVATION

High Speed Rail (HSR) lends us the perfect example.

Chinese High Speed Rail manufacturers are now some of the most innovative on the planet. After gaining a foothold in the Chinese market, foreign HSR manufacturers were quickly out-paced by their Chinese counterparts. Where HSR manufacturers traditionally focused on incremental innovation, today Chinese manufacturers are pursuing large-scale *'disruptive innovations'*.

In as little as three years, Chinese engineers have taken inspiration from (some would say 'copy') and dramatically improve upon existing HSR technologies (Wall Street Journal, 2010). Already Chinese HSR companies hold close to 1900 patents for HSR technology (Xinhua News Agency, 2011). They operate trains at a significant speed premium over their competitors and only typically require the advanced electronics and signaling components from their European competitors (Wall Street Journal, 2010).

Foreign competitors accuse the Chinese manufactures of 'stealing', but the Chinese see it differently. China acknowledges that the trains its companies are selling were developed using foreign technology. The Railway Ministry stated *"China's railway industry produced this new generation of high-speed train sets by learning and systematically compiling and re-innovating foreign high-speed train technology"*. One senior engineer was quoted as saying *"we attained our achievements in high-speed train technology by standing on the shoulders of past pioneers" (ibid)*.

The lesson is simple: If a growing market is not being effectively saturated by an existing technology or company, someone else will find a way to satisfy that market need.

5.3.2 POTENTIAL SOLUTIONS

The authors provide the following solutions to resolve the issues associated with system design and industry risks detailed in the previous sections:

- Identify system characteristics that require innovation for the UPT market and invest in research and development in those core areas.
- Do not assume, despite initial successes, that the performance-cost package of a ski-lift style gondola will be appropriate for the UPT market.
- Understand that the needs and wants of the UPT and TW markets are different. While the TW market still makes up the majority of ropeway industry revenues, the needs of that market should not dictate the products offered to the UPT market. These are two dramatically different markets and should be treated accordingly.

6 CONCLUSION

A number of strategies and tactics have been presented to help assist market growth of ropeways in the UPT market. The previous sections 5.1, 5.2 and 5.3 have highlighted what the authors believe to be the most significant barriers constraining the industry's growth into the UPT market. Recently, a body of research has been accumulating that explains the merits of urban gondolas for urban public transportation. There is little doubt the technology has significant application potential within the UPT market. However, little research exists that provides a critical appraisal of the actual implementation from a marketing and design perspective, or that offers implementation strategies to better realize market opportunities.

Optimizing the urban market requires a two-pronged strategy:

- Tailoring communication and marketing to UPT and
- Tailoring system design to UPT.

Of utmost importance is the need to address the underlying structure that takes the product to the market — that being accurate and effective communication of research to appropriate decision-makers and their staffs. This core structure is woefully lacking and currently counterproductive to realizing market opportunities — the *"urban disconnect"*. The industry offers a competitive UPT technology, but unless the benefits are properly communicated to the end consumers, market opportunities will not be fully realized.

Along with addressing the *"urban disconnect"* issue, technology and system design components require attention. The industry should be commended for

responding to technological limitations with innovations in the TW market. However, it is important for the industry not to ignore the needs of the rapidly growing urban public transportation market.

For the ropeway industry, UPT is the future.

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9 APPENDIX

TABLE 9.1 - SYSTEM DIRECTORY

Year	UPT oriented	Tourist oriented	TOTAL Installations	Name & Location
1974		X	1	Sentosa Island Cable Car, Sentosa Island (Singapore)
1976	X		1	Roosevelt Island Tram, New York City (United States)
1984		X	1	MART, New Orleans (United States) – now closed
1998		X	1	Teleferico Parques de Nacoes, Lisbon (Portugal)
1999		X	1	Monte Cable Car, Funchal (Portugal)
2004	X		1	Metrocable 'Linea K', Medellin (Columbia)
2006		X	1	Ngong Ping 360, Hong Kong (China)
2007	X		1	Portland Aerial Tram, Portland (United States)
2008	X		4	Metrocable 'Linea J', Medellin (Columbia)
	X			Skikda (Algeria)
	X			Tlemcen (Algeria)
	X			Constantine (Algeria)
2009	X		2	Manizales (Columbia)
		X		Funivia del Renon, Bolzano (Italy)
2010	X		5	Medellin 'Linea L' (Columbia)
	X			Roosevelt Island Tram, New York City (United States) - upgrade
		X		Koblenz Rheinseilbahn, Koblenz (Germany)
	X			Metrocable, Caracus (Venezuela)
		X		Sentosa Island Cable Car, Sentosa Island (Singapore) - upgrade

2011	X		2	Teleferico do Alemao, Rio de Janeiro (Brazil)
	X			Cali (Columbia) - under construction
Proposed High-profile UPT systems				London Cable Car (England) – recently began construction and due for completion 2012. Burnaby Mountain Gondola (Canada) – feasibility complete, transport authority leading the community consultation phase. Calgary Urban Gondola (Canada) – conceptual, transport authority funding feasibility in late 2011 – early 2012. Medellin Metrocables (Columbia) – some sources indicate two more urban gondolas are planned to be commissioned over the next few years. Caracus Metrocables (Venezuela) – some sources indicate that up to six additional CPT systems are proposed for Caracus.