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The gendered impacts of technological change for public transport workers in the Global South

Tessa Wright, Queen Mary University of London, Mile End Road, London E1 4NS,
t.wright@qmul.ac.uk

Abstract

The automation and digitisation of work are heavily impacting on the public transport workforce worldwide. Many of the jobs affected are those typically done by women. Yet much discussion about the future of work in public transport is gender blind, or considers women primarily as users of public transport. This paper draws on original research commissioned by the International Transport Workers Federation (ITF) to address this gap, based on five cities that have introduced changes to public transport with significant implications for women's employment – Bangkok, Bogota, Cape Town, Mexico City and Nairobi. It was a qualitative study involving 164 interviews in five cities, primarily with women transport workers but also union representatives, community organisations, policy makers and employers. It finds both opportunities from and risks to women's employment, including the chance to move from informal work to new formal employment, as well as job loss from integrated fare payment systems. It considers the possibility of breaking down traditional patterns of occupational gender segregation in public transport when new systems or technologies are introduced. However in order for women to move into traditionally male jobs such as driving in greater numbers, several barriers must be addressed, such as gender stereotyping, violence at work and working hours and shift patterns. The paper offers some suggestions for how unions, employers transport authorities and funders can address such barriers.

Keywords: Women public transport workers, automation, job loss, occupational gender segregation, workplace violence, trade unions

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Introduction

The public transport workforce worldwide has already experienced many changes from the automation and digitisation of work, with further technological developments predicted. Many of the jobs affected are those typically undertaken by women, for example in ticket sales and fare collection. However much of the discussion about the future of work in public transport does not explicitly consider its gender effects, or instead considers women primarily as users of public transport, rather than as workers. The paper therefore introduces a gender lens to consider the risks and opportunities from technological change in the public transport sector for women, drawing on evidence collected for a report for the global union body the International Transport Workers Federation (ITF) based on research conducted in five cities in the Global South – Bangkok, Bogota, Cape Town, Mexico City and Nairobi¹. The transport sector globally is highly male-dominated, with women mostly occupying lower-paid clerical and administrative roles, thus the paper will draw on

understandings of how occupational gender segregation shapes notions of transport work to result in low pay and status for women workers. However the paper argues that breaking down gender norms within transport work, for example in relation to driving jobs, can offer opportunities for improving women's labour market position, although it finds that gender cultures and structural features of transport sector work are resilient obstacles to overcome.

The paper considers the extent to which women's jobs are put at risk when new transport systems are introduced, or automation of existing systems occurs, and what factors may mitigate job loss. An important feature of the transport sector in the Global South is the predominance of informal work, especially in Asia and Africa where most urban passenger transport is entirely informal, with women commonly found in precarious jobs (ITF, 2017). Therefore the paper will contribute to the 'formalization debate' (Chen, 2012) by considering whether new transport systems or technologies can offer women opportunities to move from informal to formal employment, and what conditions are required for this to be effective in overcoming traditional patterns of occupational gender segregation in public transport work.

The first part of the paper outlines women's current unequal participation in the transport workforce globally, providing some explanations for this in theories of occupational gender segregation and conceptualisations of machinery and technology as associated with masculinity. This section also notes the paucity of academic literature within the transport field that specifically addresses women transport workers' experiences, but draws on the small body of existing work to highlight some of the common conditions of work for women public transport workers, such as persistent gender stereotypes, inflexible shift patterns and gender-based violence. The paper then outlines predictions for the future of work in the face of technological change, which anticipate particular risks of job loss and changes in the nature of work for both public transport workers and for women workers, due to their concentration in potentially automatable administrative and clerical roles.

The paper then explains the collaborative methodology adopted for the empirical research, commissioned by the ITF, which aimed to gain perspectives from five cities in the Global South on the future of work for women in public transport in order to inform ITF strategy and campaigns on protecting and improving women's jobs in public transport. The five cities selected as the focus for the research were chosen because they have each introduced, or are in the process of introducing, a new form of transport system or are extending an existing transport mode that has significant implications for women's employment. In terms of contribution to research on the public transport workforce, this empirical material both brings the perspectives of women workers, often overlooked as observed above, and original data from cities in the Global South. There are two notable features of urban public transport in the Global South which this research highlights – the extent of informal work, as noted above, and the popularity of externally-funded transport schemes such as Bus Rapid Transit (BRT) where lending comes with conditions including the operation of a public-private partnership model, which may be disadvantageous for worker terms and conditions (Rizzo, 2015).

Drawing on the research conducted in these five cities, the paper examines the effect of technological change on job loss for women, but finds that this has in some cases been mitigated by trade union agreements over redeployment. It then considers the opportunities that may arise from the introduction of new transport infrastructure, combined with technological developments, to

break down traditional patterns of occupational gender segregation in the sector which have historically excluded women from better-paid roles such as driving. However it finds that even where there is a desire by employers or public transport authorities to increase women's numbers in non-traditional roles, there remain many obstacles to women's increased participation. Such barriers include persistent gender stereotypes, working hours and shift patterns that are difficult to combine with family responsibilities and unsafe and at times sexually abusive working environments. Conceptions of masculinity persist in assumptions about driving and operating machinery, while sexual harassment and violence are common, combining to exclude women from 'men's jobs'. Fear of violence is also a factor in deterring women from the early morning or late night working patterns often required of transport workers, with lack of flexibility over hours precluding participation of some women with family responsibilities.

The paper concludes that employers, trade unions, transport authorities and funders all have a role to play in ensuring that women can benefit from any new job opportunities arising from technological change, as well as seeking to protect existing employment as far as possible. It anticipates that the recently-adopted International Labour Organisation *Convention on Violence and Harassment in the World of Work, Convention 190* may offer a new framework for action on tackling and preventing violence and harassment at work, recognising the interrelated effects of gender-based violence and harassment, gender stereotypes and unequal gender power relations, which underpin occupational gender segregation.

Women in the public transport workforce

Data on the employment of women in the transport sector internationally are difficult to find, but available data suggest that women are massively under-represented in transport work; LABORSTAT figures indicate that women constitute only one in seven transport workers around the world. Wide country variations exist, with women accounting for 30 per cent of those in transport, storage and communications occupations in Botswana (compared to 43 per cent labour market participation) but only one per cent in Pakistan (compared to 13 per cent labour market participation) (Turnbull, 2013: table 1, p.3). . In the urban public transport sector in the EU, women accounted for only 17.5 per cent of employees overall, with proportions of women varying by country from five to 31 per cent (Project WISE, 2012). Women's presence in technical or operational roles such as drivers is especially low – often under 10 per cent. They are commonly found in air transport jobs such as flight attendants, with check-in and customer services accounting for large proportions of women (Turnbull, 2013: p.5)

Women's low participation in the transport sector is typical of patterns of occupational gender segregation that have been found to occur across the world, under all political systems and at all levels of economic development. Indeed occupational segregation by gender has been identified as "one of the most important and enduring aspects of labour markets around the world" (Anker, 1997: 315) although its degree and specific forms vary in different national contexts, as the figures above show. Nonetheless, occupational gender segregation is a major contributor to the lower wages of women (Walby, 1988). There are broadly three types of theories that seek to explain occupational gender segregation: neo-classical and human capital theories; institutional and labour market segmentation; and feminist or gender theories. Human capital theories emphasise women's lower level of education and work experience (due in part to childcare responsibilities) to explain

differential labour force participation, however evidence shows that women's increased educational achievement is not necessarily matched by increased pay or opportunities to progress within occupations (Bagilhole, 2002). Labour market segmentation theories, notably dual labour market theory, categorise the labour market into primary and secondary sector jobs, with men found in greater numbers in the better paid and more secure primary sector, and women in lower paid insecure secondary jobs. However these theories are not adequate alone to explain *why* occupations are segmented by gender (Anker, 1997), nor why women have increasingly succeeded in entering primary jobs in management and the professions (Walby, 1997). Thus theories that focus on gender stereotyping and gendered attitudes are also needed to explain the persistence of patterns of occupational segregation by gender in some sectors, such as transport, while changes have occurred in other parts of the labour market.

The sex typing of jobs is rooted in essentialist notions of women's and men's abilities and skills, stemming from socially constructed notions of femininity and masculinity. Characteristics such as a caring nature, lesser physical strength, lesser ability in maths or science, greater manual dexterity are stereotyped as female and then associated with jobs that women are considered to be suitable for (Anker, 1997). Conversely men are associated with characteristics such as aggression, emotional stability, authority, self-reliance, decisiveness and desiring responsibility that fit them for management or leadership positions (Schein, 1973). Furthermore the historical association of technology with masculinity is based on social and cultural beliefs that naturalise male skills and abilities as technical, physical and rational, giving men dominance in jobs associated with technology, machinery and physical activity (Cockburn, 1983; Wajcman, 2006). While such constructions shape the jobs that are considered appropriate for women and men, these beliefs are culturally variable, as indicated by evidence that women in India undertake the heaviest manual work in construction (Wells, 2004) but are deemed unsuitable for such physical work in most other parts of the world. Nevertheless Bagilhole (2002) points out that generally the work that women do is valued less than men's work, regardless of variations in what that work consists of.

Work is central to how masculine identities are constructed, with the workplace an important site of the production of masculinity (Lupton, 2000). Depending on the nature of the workplace or occupation, the expression of masculinity takes different forms. For example, Paap (2006: 137) has described how 'pigness' is used on US construction sites to denote a form of working-class masculinity. Despite the seemingly insulting nature of the term, men used it about themselves to assert their "animal" strength and physicality, associated also with a raw sexuality, that defines their masculinity and places it above femininities or more "effeminate" white-collar masculinities. Thus in highly male-dominated sectors, including transport, particular expressions of masculinity, often associated with the display of heterosexuality (Collinson and Hearn, 1996) (author) are an assertion of power over both women and other men who are not considered sufficiently masculine. Indeed sexuality may be used to control women or exclude them from 'men's jobs', often through sexual harassment (Cockburn, 1991; Collinson and Collinson, 1996; DiTomaso, 1989; Stanko, 1988).

Published academic research on gender in the transport sector tends to focus on gender differences in transport use (i.e. Hamilton et al., 2005; Turner, 2012) and its restrictive effect on women's labour market participation (Dobbs, 2007) or on female-dominated areas such as cabin crew (Hochschild, 1983; Simpson, 2004; 2005; Whitelegg, 2009), although there are a small number of historical accounts of women transport workers (Rotondaro, 2004; Stanley, 2008; Wojtczak, 2005). Some

exceptions include a study of the effects on women managers of restructuring in the transport and logistics sector (Simpson et al., 2003) and research on women urban transport workers in Europe (Cunha et al., 2014; Project WISE, 2012; Scheller, 2011). The benefits to employers of including more women in the transport workforce can be to address skills or labour shortages, to benefit from skills that women may bring to the role such as communication with passengers, and the introduction of more flexible work patterns that can assist all workers and may improve retention rates (Project WISE, 2012).

Working hours and the difficulties of achieving work-life balance were identified as key barriers to women's participation in transport occupations, particularly in urban transport jobs such as bus, tram and train driving which may require early, late or night shifts which do not offer flexibility for those with childcare responsibilities (Project WISE, 2012). However a study of women bus drivers in Paris found that some felt that the shift patterns allowed periods of free time during the afternoon and evening, enabling them to collect children from school and spend time with them in the evening, although the study also noted a lack of collective challenge to the 'out-of-synch hours', which were accepted as intrinsic to the job (Scheller, 2011). Cunha et al's (2014) study of women bus drivers in Portugal found that their entry to the job coincided with industry changes that introduced less stable working patterns and less favourable contracts, with women placed on the newer less favourable contracts. The new shift arrangements included working days with a break of two to five hours between shifts, on any line or any schedule, with little advance information of shifts (Cunha et al., 2014). While these new working patterns had ostensibly been introduced as a 'transition' into higher status and more secure positions, the research found drivers also undertaking these shifts at later stages of their careers, for long periods. The authors concluded that policies introduced to reduce staff had resulted in an increase in precarious status (Cunha et al., 2014: 438).

Women's occupation of lower status positions was also identified in the EU study, which found that in nearly every company in the research, more women were working as metro or tram drivers than as bus drivers (Project WISE, 2012). The explanation given by the report authors was that tram drivers do not need additional qualifications or special driving licenses (which is likely to be reflected in lower pay levels). Another reason was that tram driving provided more safety and security from the public with closed cabins for drivers (Project WISE, 2012).

Violence is a significant issue for women working in operational transport roles, and it is an industry that records one of the highest levels of violence towards employees. This was the main concern for women in international research for the International Labour Organization (Turnbull, 2013), and may take the form of harassment, abuse or violence from male colleagues, or from passengers.

Research on the experiences of women transport workers in the Global South is also scarce, although this may increase as greater attention is paid to women as taxi drivers, in particular with the entry into the market of platform taxi work. A review of literature on the working conditions of taxi drivers worldwide confirms that taxi driving is a predominantly male occupation, with little research on women taxi drivers for this reason (Poó et al., 2018). But what little research exists confirms that women drivers experience high rates of sexual harassment and violence (Berrones-Sanz and Araiza-Diaz, 2019). A study of women taxi drivers' work conditions and health in Mexico City reported that only 1.4% of drivers were female (1,217 women) (Berrones-Sanz and Araiza-Diaz, 2019). It found that women had lower hourly rates of pay, mostly because they work in places with

fewer passengers. They also work longer hours than men – working on six days in a week – which was related to poorer health outcomes.

Platform taxi-driving work has been promoted as offering flexible employment opportunities for women by the International Finance Corporation (part of the World Bank Group) and Uber (IFC and Uber, 2018). Their survey of women in six countries found that flexible working was the most popular reason given for choosing this work by women drivers (cited by 74 per cent of women compared to 64 per cent of men). The IFC and Uber report suggests that ride-hailing platforms are enabling greater numbers of women to enter taxi driving, with about 20 per cent of drivers who use the Uber app in the United States being women. However figures were considerably lower for the six countries examined in the report: the average was 2.3 per cent women drivers, with the highest proportion in Mexico at 5.2 per cent. The report found that the barriers to women joining Uber were primarily felt to stem from concerns about safety and security, and 26 per cent of women drivers cited personal security as the reason for not driving more hours (IFC and Uber, 2018). While instances of physical assaults by riders were relatively rare, some drivers reported having experienced verbal abuse and sexual harassment.

Many academic studies focus on the economic development effects of Bus Rapid Transit (BRT) in developing countries, particularly in relation to increasing access to employment for poorer populations (for example, Heres et al., 2014; Oviedo et al., 2019; Venter et al., 2018). A few highlight the impacts on transport workers and trade unions of the introduction of BRT (Paget-Seekins, 2015; Porter, 2010; Rizzo, 2015), but none consider the impact on female workers. Yet an unpublished briefing by the ITF on the Bogota BRT system highlights many concerns for women workers. For women drivers, split shifts, experiences of verbal and sexual violence, and licence requirements were all obstacles to greater number of women entering the role. For women ticket sellers, passenger violence, inadequate facilities such as toilets, and age discrimination were highlighted as issues (ITF, n.d.).

Many of the world's transport workers are informal, especially in Asia and Africa where most urban passenger transport is entirely informal (ITF, 2017), which compounds the problem of estimating the size of the female and male workforce. Informal work encompasses a range of jobs from bus, minivan and taxi drivers, conductors, despatchers, porters, cleaners, inspectors, booking clerks and ticket agents to associated roles at transport terminals such as toilet attendants, security guards, food vendors and waste-pickers. Indeed the majority of workers worldwide are in the informal economy (Rizzo, 2013) and this form of working has expanded across sectors, in part in response to the worldwide recession (Chen, 2012). Women tend to be concentrated in the more precarious forms of informal employment (Chen, 2012) and in some countries they are found in significant numbers as informal drivers, vehicle-owners and conductors, but they are most commonly occupy the most precarious, vulnerable and low paid jobs – such as cleaning, vending and catering (ITF, 2017).

There is thus an increasing recognition in policy terms that addressing the needs of working poor women in the informal economy is a key route to reducing women's poverty and gender inequality (Chen, 2012). One central policy question is whether and how to formalize the informal economy – the 'formalization debate' (Chen, 2012). One way of doing this is to shift informal workers to formal wage jobs, requiring the creation of more formal jobs. This approach is reflected in ILO

recommendation no. 204 on *Transition from the Informal to the Formal Economy* which sees the transition to formal status as means of achieving decent work (ILO, 2015).

An alternative perspective highlights the destruction or undermining of existing employment in the informal economy by urban renewal schemes that demolish informal places of work, and calls for urban planners and local authorities to embrace the informal economy as the main generator of jobs and livelihoods in most cities in the developing world (Chen, 2012). What is needed, according to Chen, is a hybrid economic model that includes both the informal and the formal, noting that this would allow informal transport workers to be integrated on equitable terms in public and private transport systems, for example (2012, p,20). This approach is echoed in a labour impact assessment of the proposed introduction of a BRT system in Nairobi, which emphasises the need to consider the effect of changes on the large informal workforce in transport, by ensuring that the wide range of associated occupations is also considered (Global Labour Institute, 2019).

The future of work for women in public transport

International data show that women suffered three-quarters of the job losses in transport between 2008 and 2011 (Turnbull, 2013). Predictions about the future of work for both transport workers and women workers show that this trend is likely to continue. A study of jobs in the United States examined over 700 occupations, dividing them into high, medium and low risk of automation over the coming decade or two (Frey and Osborne, 2013). The results predicted that most workers in transportation and logistics, office and administrative support and production occupations were at risk, together with a substantial share of employment in service occupations. Despite criticism of the reliability and methodology of the study (Arntz et al., 2016), it nevertheless indicates trends that are of concern for transport workers and for women workers. Further evidence suggests that the risks and benefits from automation are not shared equally among workers. The World Economic Forum (2016: 13) survey estimated that two-thirds of job losses would be in administrative and clerical jobs, which are jobs typically occupied by women.

Additionally, analysis of UK data by the Institute for Public Policy Research (IPPR) (Lawrence et al., 2017) shows that – while automation is increasingly likely to also affect high skilled work – jobs with the highest potential for automation typically have lower wages. On average, low-wage jobs have five times the potential to be automated compared to high-paid jobs. Furthermore, a greater proportion of jobs held by women in the UK are likely to be technically automatable, compared to men. Additionally women make up a smaller proportion of those in high-skill occupations that are more resilient to automation. The IPPR report concludes that while automation is unlikely to create a future of mass joblessness, it seems likely that it will accelerate inequalities of wealth and income, unless there is significant policy intervention to address this.

The rather more optimistic World Economic Forum (2016) report, however, emphasises the potential to reduce gender gaps in employment, as women continue to enter the workforce in increasing numbers and to fill labour shortages in some areas, together with the potential for technology to offer more flexible work. Additionally it suggests a possible growth in transportation and logistics roles, due to the need to connect countries and industries in the wake of increasing globalization, as well as increasing numbers of travellers from rising middle classes in emerging markets. However it concurs with other evidence above in recognising that many of the office and

administrative occupations held by women are being lost, while many of the growth occupations are male-dominated (i.e. architecture, engineering, computing).

Given the previously noted historical association of technology with masculinity (Cockburn, 1983; Wajcman, 2006), there are concerns about how far women may benefit from any projected job growth in these areas. Wajcman notes that despite the rhetoric proclaiming opportunities for women in the new knowledge economy, men continue to dominate technological jobs, with women's representation in information technology, electronics and communications actually declining by around 10 per cent. She concludes that: "gender is a marker that still functions to sort out high-tech from low-tech or no-tech" (Wajcman, 2006: 780).

A final point to note is that many predictions of future job reorganisation as a result of new technology are based on official data sources from the high-income OECD countries or from the USA (Arntz et al., 2016; Frey and Osborne, 2013) and thus do not capture the likely extent of job loss in developing countries. Here employment in the informal sector is much higher and therefore numbers are unrecorded, as already noted. It is therefore necessary for assessments of the impact of future transport systems, particularly in developing countries, to take account of the large informal workforce likely to be affected, in particular by consulting with worker representatives (Global Labour Institute, 2019).

Methodology

The research on which this paper is based was conducted for International Transport Workers Federation (ITF), with a research team led by the author, employing a collaborative research methodology. This involved researchers conducting fieldwork in each of the five selected cities, in consultation and discussion with the ITF Women's Department. They were additionally supported by ITF regional officials, who provided links to relevant trade unions in each city. A research workshop was held in Bogota, attended by 20 participants, including all the researchers, nine union representatives from the five cities covered by the study, ITF head office and regional representatives. This provided an opportunity for researchers to discuss their initial findings with the research team, as well as providing further input into the research from union representatives who commented on the initial research findings and presented their experiences of organising and campaigning for women within the public transport sector.

The five cities for the research were selected by the ITF because they had introduced, or were in the process of introducing, a new form of transport system or an extension to an existing transport mode, which was expected to have significant implications for women's employment. Bus Rapid Transit (BRT) was introduced in Bogota in 2000, in the form of Transmilenio, and a similar BRT system, MyCiti, was introduced in Cape Town in 2010. Nairobi had extensive plans to introduce a BRT system, with the first phase opening in 2019. In Mexico City, plans for upgrading the city's public transport include a proposal for a dedicated zero-emission corridor for electric buses, while in Bangkok, public transport expansion was in the form of rail, particularly the airport link opened in 2010, and expansion of the Skytrain and metro networks.

Researchers in each of the five cities collected three main forms of data: statistical data on women's participation in the public transport workforce; documentary material; and interviews. Reliable statistical data on women transport workers proved to be unavailable in some cities, although

estimates were obtained from a variety of sources. However as this data is incomplete it is not presented here. Types of documents reviewed included: academic journals; newspaper and magazine articles and web sources; television documentaries and clips; reports from national and international organisations covering the future of work and technology; national and regional policy documents on transport; company documentation; and union reports. These informed the analysis contained in the country reports provided by the local researchers.

Interviews provide the primary source of original data on which this article is based, and were chosen for the research as the most suitable way of addressing the research questions about women's experiences of transport work and perceptions of other public transport actors about the future of work for women in public transport. Therefore interviews were conducted between May to August 2018 with key experts, including women public transport workers. In total 164 interviews were carried out with a range of stakeholders, which covered: women public transport workers; union representatives within public transport plus representatives from ITF regional offices; community organisations and NGOs with a focus on women's rights and/or urban transport; policy makers, local politicians and employers.

Analysis of documentary material and interviews was initially carried out by each local researcher or research team, based on an agreed set of themes, and presented in a summary research report for each city. This material was then analysed by the research co-ordinator (the author), who also had access to original interview materials or translated extracts, with clarifications and interpretations carefully checked with the local researchers. The research co-ordinator then produced the final project report, which was again checked for accuracy of interpretation by the local researchers and the ITF project team.

There is a danger that research on cities in the Global South, co-ordinated and analysed by a researcher from the Global North, will perpetuate "a historical hegemony of predominantly western worldviews, concepts, theories, methods and research practices" as Schwanen has noted in relation to geographical scholarship on transport (2018: 464). He develops a classification of three approaches found in geographical research on transport. 'Transfer' refers to the deployment of western worldviews, concepts, theories, methods and research practices to understand the geographical aspects of transport in Africa, Asia or Latin America. 'Mobility' adapts or modifies elements of originally western worldviews, theories, concepts or methods to fit local circumstances, adopting greater sensitivity to particularity and geography, while retaining a western centre of theoretical production. His final category 'worlding' seeks to overcome western hegemonic thought by introducing new, site-specific worldviews, theories, concepts, methods or research practices that can "speak back to western versions" (Schwanen, 2018: 464). While this paper makes no claim to be employing a worlding approach, it is to be hoped that the collaborative methodology in which the research was undertaken by local researchers in each city, with input from trade unionists from each of the cities and ITF representatives from Africa, Asia and Latin America, has at least tempered the western bias.

[Automation: job loss or opportunity?](#)

Undoubtedly technological innovations introduced as part of a move to integrated public transport systems, which include automatic ticket vending machines, have led to loss of jobs in many cases. The findings of this research indicate that this has primarily been among informal workers or has

resulted from the introduction of integrated ticketing systems. Bus Rapid Transit (BRT) is being introduced in many cities to increase capacity and ease congestion, based on dedicated road lanes for buses only, together with new interchanges, terminals and stations. The introduction of the BRT system in Mexico City, for example, included new self-service ticket machines, whereas previously minibuses provided services on most of the routes covered by BRT, and women commonly operated as co-pilots (usually partners of the drivers) or as those collecting fares, all working informally. As a result of the introduction of BRT routes, many informal workers lost their jobs, as warned of in previous studies (Global Labour Institute, 2019).

Similarly in Bogota, before the introduction of a BRT system in 2000, the city's public transport was predominantly provided by buses, known as *busetas*. These are gradually being incorporated into the Sistema Integrado de Transporte Público (SITP), which provides an expanded feeder system to complement the BRT system. When buses were incorporated into the SITP in 2012, the introduction of an integrated card for all BRT and SITP services was accompanied by some automation of ticket sales and job loss. TransMilenio S.A. is the body that manages the BRT system, under a public-private model, which subcontracts bus operation and maintenance to 18 companies, and the collection of fares and the provision of technological services (i.e. screens inside buses and stations) to a company called Recaudo. Research participants highlighted concerns that Recaudo sees itself primarily as a technology company, with workers simply acting to support fare collection machines, with plans to reduce station staff to the level of only one worker controlling access to the station and assisting passengers to charge their card using the machines. However the pilot of this system led unions to highlight the dangers to workers of being robbed. There are also considerable risks to lone working in such roles, and around 80% of those who work for Recaudo in money collection positions are women, who face further dangers of passenger abuse and sexual harassment (discussed further below). At the time of the research, no firm plans had been agreed for further automation of ticketing, although the contract agreed between Transmilenio and Recaudo enabled this in future in order to achieve specified levels of service.

The unreliability of the technology has also thwarted attempts at further automation. On the Mexico City subway there have been three attempts to automate ticket sales, but according to one worker, the machines tend to break down or users are uncomfortable with the technology. Prepaid cards were introduced in 2012, but these are recharged by ticket sellers, rather than a self-service machine. In Cape Town the system of integrated payment cards, MyConnect, has not been as effective as promised, as there are few outlets that provide charging facilities, and it has resulted in high costs to the city. Cape Town is currently seeking to introduce an 'open' system, which would involve a number of independent service providers developing their own products to make payments, for example using mobile phone apps, bracelets, bank cards and so on. The city also wants to introduce an integrated ticketing system for payment across trains, buses, taxis and the MyCiti system. These technological developments would be likely to result in job loss for women workers as the majority of cashiers currently are women, as predicted by the future of work literature outlined above.

On the other hand, the research found that where workers affected by automation are unionised, unions can reach agreements with the employer to protect jobs through redeployment of workers to other roles. In the case of ticket sellers affected by the introduction of self-service ticket machines

on light rail in Mexico City, workers were transferred to office positions or to jobs as ticket machine facilitators. Some of them reported improved conditions at work:

“Now I just help users who do not know how to use the machine. At the beginning there were a lot of people who need my help, but now, I stay most of the time free, I do not need to deal with stressful situations anymore. Usually I just work a lot when there is a football match, when the demand is very high and they need our help.” (Woman worker, light rail, Mexico city)

In fact, additional positions were created by the introduction of self-service ticket machines, working for an outsourced company that assists users with problems such as blocked cards. This is a job undertaken mostly by women, and offers flexible schedules that suit some women, such as those studying or with childcare responsibilities. However the research noted that the outsourced company does not offer such good terms and conditions in other respects as the previous employer. In this way particular forms of technology may create jobs available to women workers, counter to Wajcman’s (2006) fears about men dominating technology-based work, and may even offer greater flexible working patterns than customer-facing positions. However the apparent worsening of other terms and conditions for these new roles may reflect a gendered differentiation of status in different forms of technology-based work, as well as the risk of outsourcing leading to worsening of worker conditions.

Nairobi’s plans for a BRT system have been subject to numerous delays, with the first pilot route expected to be operational by December 2019 (Pandey and Paul, 2019). Previously public transport was largely provided by the informal ‘matatu’ sector, made up of passenger buses, mini-buses and 14-seater vehicles. Most of the matatu owners and drivers are men, but women commonly work in many of the informal jobs associated with the matatu sector, primarily stage workers, which include callers, pigasetti (‘seat warmers’ who pose as passengers to create the impression that the vehicle is getting full), clerks and wardens, stage security workers (screen boarding passengers for security) and food vendors, likely to be among the most precarious and low-paid.

Predictions for job loss overall from the introduction of BRT in Nairobi have suggested that around 30,000 matatu workers and associated informal workers may lose their jobs, with an estimated 5,760 jobs created (Global Labour Institute, 2019). The report does not give an estimate of job loss for women, but notes that the on-board crews, who are more likely to be men, represent around half of expected job losses, while some of the other at risk occupations include jobs commonly done by women such as ticket or food vendors.

Nevertheless interviewees were optimistic about the potential for the new BRT system to provide opportunities for women’s employment. It is anticipated that BRT will shift women’s work from the informal sector and provide formal and secure jobs for women, reducing the number of working hours and precarious nature of women’s work. Jobs will be created for drivers and conductors, as well as in ticketing, booking, cleaning, mechanical maintenance, accounting, customer relations, marketing, and information, communication and technology (ICT) and app management roles. Such expectations are in line with objectives to promote decent work through formalisation of the informal sector (ILO, 2015), but rely on the creation of sufficient numbers of formal jobs to offset the contraction of the informal sector (Chen, 2012), or the result will be net job loss, as the Global Labour Institute predicts. Furthermore, women will only benefit if they acquire the necessary skills,

and therefore training is crucial. Of the women workers interviewed for this research, only six out of 29 had so far had additional training either as a driver, in business administration, accounts or basic security management, although the Nairobi Metropolitan and Transport Authority had confirmed that there would be training for BRT workers. Again here an important question will be the relative value accorded to different jobs and roles, both technical and driving. It will be important for new pay structures to avoid replicating previous gendered hierarchies, such as the lower status and pay of metro or tram drivers (where more women work) compared to bus drivers (mainly male) in the EU study (Project WISE, 2012).

Breaking down occupational gender segregation

The introduction of new transport systems, such as BRT, provides opportunities for women to move into new roles, including those previously mostly undertaken by men, such as driving. Yet as highlighted above, women need sufficient retraining and reskilling in order to equip them for such opportunities.

In Cape Town the BRT system, MyCiti, was introduced in 2010. A training strategy was adopted to increase the number of female drivers by one of the vehicle operating companies. It had been recognised that women were less likely to have the necessary driving licences so the company decided to use sponsored learnerships – funded training opportunities – from the Transport Sector Education and Training Authority to train women to gain licences. Learnerships were allocated on a ratio of 80:20 women to men. According to an interviewee, the proportion of women working as duty bus drivers had reached just under 40 per cent. While some of the women were previously unemployed, some had been employed as drivers in other contexts, where heavy duty licences were not required, such as in tourism.

By targeting unemployed women or those with driving experience in other sectors, the company was altering its practice of recruiting drivers from among the city's taxi drivers, predominantly men. When MyCiti was introduced, negotiations were held with the taxi industry, who feared loss of work as a result of the new system, to prioritise taxi drivers in recruitment. This was part of a strategy to ensure black economic empowerment, in compliance with South African legislation, as historically taxi driving was an occupation of many black men, initially under the apartheid system, during which period public transport, particularly for the working class, was inadequate. Many taxis started operating illegally, without permits, in order to get people to work. In addition, the movement of black men and women was tightly controlled, particularly in the cities. During the 1970s many white middle class South Africans drove large Valiant cars, but these became a burden when the oil crisis struck and many were bought by black men who began using them as taxis, often transporting workers in and out of white areas where they worked, and driving Valiants made them less identifiable. Therefore a consequence of prioritising the existing black male taxi workforce in recruitment for driving jobs in the BRT system was to replicate pre-existing patterns of occupational segregation by gender in the new workforce. In adopting a training and recruitment strategy targeted at women, this one company was able to increase the proportion of women drivers above the average for other driving positions across the city.

Another issue here may be that commitments to ensure that the informal workforce is taken into account when BRT is introduced may also conflict with opening job opportunities to female workers, if the informal workers identified are primarily taxi drivers. The case of the introduction of BRT in

Johannesburg resulted in considerable challenges to overcome violent rivalry between different taxi associations, but did result in some informal taxi workers becoming formalised and becoming included within collective bargaining agreements. Indeed taxi drivers who became BRT bus drivers saw their wages doubled and their hourly rates reduced (Global Labour Institute, 2019).

A report on the implementation of Integrated Mass Transit Systems (IMTS) in Colombia by funders the World Bank notes that although the initial project design did not include any gender-specific measures, there are now “women holding positions in management, inspection areas, ticket sales, cleaning vehicles and even driving, which traditionally is associated with men” (World Bank, 2013: 25). While this may represent an increase in the number of women in driving roles, the ITF points out that less than 10% of drivers are women, with only four out of the nine companies that operate buses employing any women as drivers (ITF, n.d.).

Mexico City is planning to introduce a new bus corridor on one of the main arterial roads into the city operating with electric buses only, with bicycle lanes alongside. It is being extolled for its environmental and economic development benefits, and is the first of several bus corridors envisioned to operate with electric buses only. The introduction of electric buses is an example of technology opening up opportunities for women as new roles emerge. The new buses are likely to replace some of the current trolleybuses, where there are no female drivers as the job is said to require strong physical efforts to pull down the trolleys, with reports of some men having lost fingers doing so. While the replacement of the old buses with electric buses may not challenge gendered assumptions about women’s physical capabilities (Anker, 1997), they are generally believed to be safer and easier to operate, and may be more appealing for women drivers.

Mexico City’s electric bus corridor development is supported by the government in partnership with significant funding from international agencies - the C40 Cities Finance Facility, supported by the German, UK and US governments - as a project that supports both improved air quality and economic development. Thus it provides an opportunity for trade unions and other stakeholders interested in advancing women’s employment prospects to campaign for the adoption of objectives for the inclusion of women in all roles as the project develops.

Barriers to change

However in order for women to increase their numbers in traditionally male occupations such as driving, a number of other barriers need to be overcome, in addition to training provision.

The literature discussion above highlighted several factors that have limited women’s participation in many roles within the transport sector, primarily gendered assumptions about job suitability, working hours and shift patterns, and violence at work. These were all identified in this research also, although indications of progress in some areas were noted.

Gender stereotyping

Evidence from interviews demonstrated the persistence of gendered assumptions about women’s and men’s suitability for different types of work that underpin the segregation of women and men into largely different occupations within the transport sector. For example, women’s driving capabilities are often called into question, by both passengers and fellow drivers. A female taxi driver in Nairobi illustrated this:

“There are male clients who think that they can drive better than you and are continually giving instructions throughout the journey... Some women clients also look down upon lady drivers and are arrogant when dealing with them.” (Woman taxi driver, Nairobi)

On the other hand, gendered assumptions may take positive forms in relation to women drivers, such as perceiving women to be better drivers than men on the grounds that they are less reckless, less likely to speed, more likely to be polite to passengers and so on. One woman bus driver in Cape Town said: “I often get compliments for driving – people say they feel safer with a woman driver.”

Some managers also see the benefits of women bus drivers:

“So there’s also a greater benefit to have female drivers. On the work setting per se we also have less complaints; and, yah initially the accidents soared, but once they started to get a little bit of experience, you know going into your six months, just over the curve, then they stabilise. So your accident rates go down. You get better interaction. You get people that are (sighs) reliable, they don’t just stay out of work and they don’t have that fierce, hostile driver towards the public. It’s just, we find that the female drivers give us a better fit [...] to do this type of work.” (Bus manager, Cape Town)

Gender stereotypes also vary across cultures. Whereas in Bangkok, women have only recently been considered suitable to work as metro train drivers, in Mexico City social acceptance of women operating trains is higher than women driving on roads, with smaller numbers of bus drivers. However this is based on the presumption that the operation of subway and light rail trains is easier, given the technological assistance now available, and therefore more suitable for less technologically able women, as expressed by this male driver:

“You do not need a great mind or abilities. I mean, you do not need to measure distances, or deal with other cars. In those [trains] you stay in your rail and press some buttons, that is enough! That’s why this technology is suitable for women to operate, otherwise you need men to handle all the difficulties.” (Male trolleybus driver, Mexico City)

This quote reflects exactly the conceptions of skill that unquestioningly associate mathematical ability, spatial awareness and dealing with machinery with masculinity, while also recognising the changing impact of technology on work and skill (Wajcman, 2006). In this instance the gendered dimension of new technologies is believed to assist lesser-skilled women in performing complex driving tasks, as long as she “stays in her rail”.

A woman security guard in Bangkok highlighted the challenges that she faced in being taken seriously by passengers:

“Security guard is a man’s job. When I tell the passengers to wait before getting into the train, sometimes they don’t listen or care. They will listen to the male security guards because they look fine and strong.” (Woman security guard, Bangkok)

These quotes all highlight the persistence of gender stereotypes that sustain occupational gender segregation, although in some instances negative gender stereotypes about women drivers are reversed to promote the positive benefits of women drivers. While this reversal does little to

challenge essentialist notions of gendered skills and abilities, these arguments may be used as part of a 'business case' for increasing the numbers of women drivers, based on their presumed attention to safety.

While it is important to persuade employers of the capabilities of women as drivers, it is also necessary to do more to educate passengers to behave in a respectful way towards women drivers, according to interviewees. A male TransMilenio driver in Bogota believed that although macho attitudes among drivers and passengers persist, there has been an improvement, but he felt more could be done to educate passengers: "I believe the district (DSM) should give training or information through TV and radio to educate users." A similar suggestion came from an interviewee in Nairobi who proposed that stickers containing messages like "Respect my Job" should be put inside public transport vehicles to educate passengers about women's role, or that screens in the vehicles should be used to promote positive messages about women's employment.

Thus transport authorities and employers who are seeking to increase women's numbers in driving positions need to ensure that there is education and public awareness campaigns for both staff and passengers about respectful behaviour towards women drivers and station and security staff, just as they do about passenger violence towards male and female staff.

Violence at work

In all cities included in this study, public transport workers were at risk of violence, with women facing particular risks, including from sexual abuse and harassment, which constrain their participation in certain jobs or at certain times. While sexual harassment is increasingly addressed as a responsibility for employers, policies and procedures often have greater purchase and effect in white-collar office environments, and fail to reach many of the stations and depots where transport workers spend their days (author).

In Nairobi a study found verbal abuse to be a common form of harassment used against both women passengers and workers in public transport (Wafula, 2018). A union representative interviewed for the present study commented:

"Public transport is not friendly to women workers and users, and both the passengers and workers experience harassment." (Male union representative, Nairobi)

Women's increased vulnerability to passenger violence, especially from those enraged by service delays or problems, was recounted by a woman train operator in Mexico City:

"One day I was operating the light train, and one male user was very upset because the service ended up one station before the final terminal. [...] Many announcements were made in every station but this man did not pay attention.... He was yelling at me, very aggressive, I should say, so I kind of ran and went to the operation cabin. Next day, a male worker told us a similar story, the same man, but this time he was not that aggressive. Anyway, the day after that, a female operator was punched on her face by the same man. The only difference was that I ran to the cabin, but instead, she stayed there in front of him trying to give him explanations..." (Woman train driver, Mexico City)

Violence from the public was identified as a major problem for workers in stations in Bogota, with some feeling that insufficient action was taken by employers and transport authorities. Those responsible for checking tickets and stopping fare dodging are particularly at risk:

"Colleagues of mine have been slapped, their hair pulled, punched. We already had a dead male colleague in the system. The measures taken by the regulatory bodies have not been effective." (Woman Recaudo Bogota worker)

In public transport systems such as Transmilenio in Bogota where operations are outsourced to multiple private companies, lines of responsibility for worker safety can be unclear and fail to offer protection. A manager commented: "The system belongs to everyone and no one." While Transmilenio has supervisory responsibility for its contractors, and can in theory impose conditions on the operators with respect to workers' rights, in reality there is no specific monitoring of the conditions of the workers among operators, only the quality of the service provided.

The evidence here is predominantly about violence from passengers, rather than male colleagues, although this was mentioned. Therefore it does not directly support the findings of other research in male-dominated sectors that sees sexual harassment as a means of keeping women out of 'men's jobs' (Cockburn, 1991; Collinson and Collinson, 1996; DiTomaso, 1989; Stanko, 1988). However preventing violence from passengers is the responsibility of employers, and if they are taking insufficient action to do so, then they are culpable for women's exit from the sector. Some participants believed that employers are not doing enough to protect female drivers from passenger violence, for example on the SITP bus network in Bogota, which has a lack of safe cabs:

"Several female drivers have been beaten by users with umbrellas, one even had sustained head injuries. The only thing the company did about it was tell them to go see their doctor. They are not going to adapt booths inside the buses just to protect us and let us drive." (Woman SITP driver, Bogota)

In Cape Town, however, some felt that the introduction of BRT had resulted in safer job opportunities for women in public transport, at least compared to the dangers of taxi driving, accompanied by CCTV camera surveillance, dedicated bus lanes and safer buses with power steering.

Night work poses particular risks for women. A union rep and former station master's assistant in Bangkok described how routes home from isolated stations are often desolate, and she had faced robbers on this route. In addition, it is not considered safe to take a taxi alone.

Furthermore, the working hours required of TransMilenio station staff in Bogota – starting at 3:30 am and finishing at 23:15 pm – mean that they must commute during hours when there is no public transport available. One woman worker recounts the lack of employer understanding of the risks faced by workers:

"For example, on a public holiday I arrived half an hour late, because there were no taxis available that day and they summoned me to a disciplinary process. Now I've had to ride my bike at 3:00 am in a city where they kill you for a cell phone. I must go out and risk my life to try to get to my job quickly. The other day I fell, and I had to work with a wounded knee all day (...) The company should be more humane." (Woman Recaudo Bogota worker)

Concerns about safety are just one of the problems of the working hours commonly required from the public transport workforce that can deter women from entering or remaining in the sector.

Working hours and shift patterns

Long working hours and shiftwork are features of public transport work that often make it harder for women with family responsibilities to participate, particularly in the better-remunerated driving positions where flexibility for workers is often not available. An example is the system of split shifts for BRT drivers in Bogota, in which a driver has a working day of nine hours, but the day can include a break of up to six hours between shifts. The break often does not allow sufficient time for drivers to go home due to the distance of their homes from work. Drivers may be required to start work at five in the morning and finish at eight at night. Both male and female drivers say this destroys their quality of life since they are not able to spend enough time with the family or undertake household tasks, but for many women it is impossible to sustain such hours and look after their children.

In Cape Town too the hours of work are a challenge for many workers, particularly women. Workers who work the first shift of the day struggle to get to work unless they have their own car, and the bus operating companies do not provide transport for their workers. As highlighted above, travel early in the morning and at night can be particularly dangerous for women workers.

These findings are consistent with other research that identifies the shift patterns of operational transport roles as presenting barriers for female workers (Cunha et al., 2014; Project WISE, 2012; Scheller, 2011). Cunha et al's (2014) study discussed above also represents a warning that the introduction of new, more flexible work patterns to which women are recruited, can also herald increased precarity of status. Indeed we saw above that the introduction in Mexico City of new positions assisting passengers with problems such as blocked cards offered more flexible schedules, but was accompanied by worsening of terms and conditions as jobs were outsourced to a private company.

In general clerical or administrative positions are more likely to offer flexible working hours, for example the hours required for work as ticket sellers on the Bogota TransMilenio system suit many women, and indeed mothers are sought out for employment. A World Bank report on the implementation of Integrated Mass Transit Systems (IMTS) in Colombia states that "mothers that are heads of families have priority in being hired for positions in ticket sales". The report goes as far as to describe the IMTS as the "mother system" of urban transport in Colombia (World Bank, 2013: 92), also noting improvements to lighting to improve security conditions and preferential seating for use by pregnant women. However the report makes no mention of the early start and finish times reported by women ticket sellers in this research, when no public transport is available, which creates safety risks for women workers. While the Transmilenio drivers (mainly men) have transport to their workplace provided by their company, our research identified that this is not available to the ticket collection workers (mainly women).

Platform taxi driving has been promoted as offering flexible work schedules (IFC and Uber, 2018), which was echoed by some of our participants. In Nairobi women found that platform work offers flexibility over hours, as expressed by one woman driver:

“...in this job, you can start and close at any time you want. It is your ability to work hard, it is not like the matatu [informal passenger bus] work where you have to start early and close late.” (Woman platform driver, Nairobi)

However alongside flexible work hours were precarious conditions with low earnings, meaning that drivers must typically work for around 12 hours to gain enough income to survive. In Cape Town, Uber drivers had to work very long hours to make sufficient income to survive, with most driving about nine to 12 hours every day. In Nairobi, the heavy competition among platform workers as competing companies under cut each other to gain passengers has resulted in low incomes. Here, platform workers may need to work for 15 to 18 hours to earn sufficient income. Information obtained indicated that several platform workers had been involved in accidents, some fatal, due to fatigue. This is consistent with research on women taxi drivers in Mexico City who were found to work longer hours than men and were more likely to work on 6 days in a week, with negative health effects (Berrones-Sanz and Araiza-Diaz, 2019).

Such hours not only pose serious health and safety risks, but also exclude many women drivers who have family responsibilities. An interviewee noted that:

“...the hours of work are not favourable for women drivers especially at night. Also some clients, both male and female, request male drivers at night for security reasons. They feel more secure when driven by males at night.” (Cab company manager, Nairobi)

Thus working-time flexibility for taxi drivers, as for other public transport workers, may be associated with precarity and risks of violence, especially for evening and night workers. Both employers and platform taxi companies who wish to promote flexible work opportunities for women in the public transport workforce need to consider safety issues when designing work schedules and shift patterns, for administrative and driving occupations.

Conclusions

This research supports the wider evidence that job loss from technological change in public transport will continue to impact on jobs occupied primarily by women, such as ticket sales and administrative work, with examples of this shown in Bogota and Mexico City. It is often the jobs of informal workers, both male and female, that are lost, providing an important reminder that when impact assessments of the introduction of new transport systems are undertaken, informal workers should be taken into account (Global Labour Institute, 2019).

However the research also highlights the challenges inherent in calls to improve working conditions for informal workers through transition to formal jobs (Chen, 2012; ILO, 2015) by showing that priority is sometimes given to informal taxi workers at risk of job loss when BRT systems are introduced, as in Cape Town, which primarily addresses male rather than female work. Evidence from Nairobi showed that women were hopeful about gaining new opportunities on the BRT, in a range of roles, but that insufficient training had so far been provided. Furthermore, we see below that formal jobs also need to provide sufficient flexibility to accommodate women’s family responsibilities.

The formalization of the bus sector can provide greater opportunities for collective action and for union recruitment and organisation, according to Paget-Seekins (2015), as workers move to larger and more regulated employers. Unions also have an important role in mitigating job loss in the face

of automation, as in the union agreement in Mexico City that protected ticket sellers affected by the introduction of self-service ticket machines by offering transfers to office positions. For some, these new positions also offered improved conditions.

In addition to the risks to jobs presented by technological change, the paper also considered the potential opportunities that may arise for women workers, for example in overcoming the occupational gender segregation within public transport that limits women's participation in higher paid roles such as driving, or in newly emerging technology-related roles. It found some evidence of women being actively recruited for driving positions, for example through using learnership or apprenticeship schemes in Cape Town, which had resulted in an increase in the proportion of women bus drivers in the city.

Despite evidence of small progress, the paper confirmed the persistence of several other obstacles to increasing women's participation in male-dominated sectors identified in the literature, notably: gendered assumptions about suitability for particular work; violence at work, including sexual harassment; and working hours and shift patterns. The empirical data revealed that conceptions of masculinity are still commonly associated with abilities such as driving and operating machinery (Cockburn, 1983; Lupton, 2000), as well as behaviours that result in sexual harassment, which can be a strategy for the exclusion of women from 'men's jobs' (DiTomaso, 1989). However, despite evidence of persisting negative stereotypes about women's driving abilities, for others women were perceived as safer, more stable drivers, therefore offering 'business benefits' to employers. While such perceptions may still represent essentialist notions of male and female characteristics, they remind us that gendered stereotypes are both culturally variable and changeable (Bagilhole, 2002). Interviewees felt that more could be done by transport authorities and employers who want to increase women's numbers in driving positions to introduce public awareness campaigns for both staff and passengers about respectful behaviour towards women drivers and station and security staff.

Working hours and shift patterns were identified as a further obstacle to increasing women's participation in transport work, also linked to gender-based violence with early start and finish times contributing to fears about travelling safely to work. Flexible hours were available in some positions, and indeed female heads of families were prioritised in recruitment for ticket sales positions in Bogota (World Bank, 2013).

While the rapidly expanding platform taxi market has been proposed as offering flexible employment opportunities for women by the industry and global funders (IFC and Uber, 2018), this study noted that in reality such flexibility was often accompanied by excessive work hours, in cities such as Nairobi where competition was pushing wages down. Additionally, early morning and night work presented risks to women workers' safety, just as for other public transport workers. Of course night work is usually the most lucrative, so women's earnings will be reduced if they feel unable to work these hours (Cook et al., 2018).

An interesting clash of strategies for achieving gender equality occurred in 2015 when UN Women (the women's section of the United Nations) announced a 'strategic partnership' with Uber with the aim of advancing economic opportunity for women through the creation of one million jobs for women as drivers on the Uber platform by 2020. This was vehemently opposed by the ITF on the

grounds that the creation of a million precarious, informal jobs would not contribute to women's economic empowerment, but would instead perpetuate the structural inequalities in the labour market that position women in insecure and precarious work (ITF, 2015). As a result of objections, the UN Women/Uber plan was withdrawn.

Implications for policy actors

As this paper draws on data from a range of cities on different continents and different occupations within the urban public transport sector, it is difficult to put forward general recommendations that would suit all contexts. However, the findings suggest some implications for various actors who have an interest in ensuring equitable conditions for women workers in the public transport sector.

Both unions and employers have an important role to play in ensuring safety for female workers, as well as passengers, on public transport systems. The research identified many concerns from women workers about violence from the public. Passenger violence affects those working in roles currently undertaken by female workers such as on stations, and fear of violence can deter women from entering bus driving roles working alone. Some design solutions to make drivers' cabs safer have been implemented, for example in Cape Town, as well as CCTV surveillance. Union campaigns have also addressed the prevention of sexual harassment and violence towards women workers and passengers, which have been particularly effective when bringing together alliances of transport unions, passenger associations and NGOs. An important point here is drawing the links between gender-based violence towards passengers and workers. An effective campaign in Maharashtra State, India, mobilised women workers and passengers together to tackle the high levels of sexual harassment, violence and rape faced by women bus conductors and bus users (Pillinger, 2017).

A further important lever for tackling gender-based violence at work, involving employers, unions and states, will be the recently-adopted International Labour Organisation *Convention on Violence and Harassment in the World of Work, Convention 190*. It was agreed in June 2019 alongside a supporting Recommendation and together they provide a strong framework for action on tackling and preventing violence and harassment at work, which specifically highlights gender-based violence and harassment. It is important in recognizing - as highlighted in the academic literature - that violence and harassment may prevent women from accessing, remaining and advancing in the labour market. Furthermore it acknowledges that as gender-based violence and harassment disproportionately affects women and girls, a gender-responsive approach is needed "which tackles underlying causes and risk factors, including gender stereotypes, multiple and intersecting forms of discrimination, and unequal gender-based power relations" (ILO, 2019). This recognition of the relationship between gender stereotypes, gendered power relations and gender-based violence is crucial for tackling the interconnected obstacles to women's increased participation in male-dominated sectors in particular, as this paper has outlined. The transport sector was particularly mentioned in the Convention as an area where change is needed. It applies to all sectors and workers, irrespective of contractual status, including those in the informal economy.

The Convention has been said to represent a significant "shift of approach from addressing issues of sexual harassment and sexism at work as individual complaints [...] towards collective consideration of them as issues of worker health and safety" (Heap, 2019). Given that the development and agreement of the Convention was influenced by campaigning from global trade unions over a long period (Heap, 2019), it is to be hoped that this momentum on tackling the issue will be capitalized

upon by the trade union movement to tackle sexual harassment and violence as issues of gender inequality *and* health and safety.

Employers are directly addressed by the Convention as having a major role to play in tackling workplace cultures that permit or even encourage gender-based violence. The connection between women workers' safety and working hours has been made throughout this study, and here again employers are key. For example, the risks for transport workers – including ticket and station staff – of early and late shift patterns and safety can be reduced by employer provision of transport to work, as was provided for bus drivers in Bogota. In relation to platform taxi work, where the model of employment is typically self-employment (even though this has been challenged in court cases around the world), then platform taxi companies need to do more to protect the safety of their drivers, for example by sharing data on violence passengers across platform companies.

This research suggests that in order to mitigate job loss and improve women's participation and working conditions in the male-dominated transport sector worldwide, targeted action is needed by a combination of trade unions, employers, passenger groups and NGOs, as well as public transport authorities. While it is beyond the remit of this paper to make detailed recommendations for transport authorities and planners, the gender-sensitive approach suggested by Turner (2012) for the inclusion of women transport user's voices in transport planning protocols to address sexual harassment could be broadened to include the views of women transport workers, possibly through their unions. Furthermore, an extension of this gender-sensitive approach could consider the needs of women as workers when planning transport systems and upgrades. Similar recommendations have been made more broadly for the involvement of civil society, including trade unions, in the design, implementation and evaluation of projects such as BRT in order to ensure strengthened democratic accountability in projects financed by the World Bank (Porter, 2010).

This leads to a final conclusion that there is a greater role to be played by funders in setting gender, as well as labour, objectives when new transport systems are planned. The Mexico City electric bus corridor project is supported by international finance through the C40 Cities Finance Facility, while the World Bank is a major financial supporter of BRT systems in many cities in the developing world. World Bank lending attaches conditions which require private companies to operate the buses, although the public sector funds the schemes, oversees the systems and is responsible for quality controls, in a form of public-private partnership (Rizzo, 2015). This model can create downward pressures on wages and can lead to lack of accountability for monitoring labour conditions, where there is no clarity over responsibilities, as highlighted here. However, further conditions on the gender impact of proposed new systems could be included to support the social development objectives of funding and furthermore to assist in meeting its gender strategy objectives to increase women's labour force participation, boost their access to higher quality jobs and increase their earnings (World Bank Group, 2015: 41). While the World Bank's evaluation of its lending for integrated transport in Colombia noted that it did not include objectives for gender-specific measures, it does claim some positive gender impacts (World Bank, 2013: 25). Additionally it supported the inclusion of disability access features into the initial design of BRT systems to enable the inclusion of disabled populations. If such equality objectives for disabled people can be included in funding conditions, then it is feasible to consider that gender equality objectives – for workers and passengers – could be incorporated into future financial support for transport systems in other cities worldwide.

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ⁱ Add link to report