Measuring the effectiveness of a transit agency's social-media engagement with travellers

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ABSTRACT

This study investigated the uses of social media for travel planning on a transit system with particular attention to travel disruptions and delays. Due to very limited research in the effectiveness of social media in a transit setting, the best practices have yet to be established. Rather than having a one-size-fits all traveller information system, these on-line services have the potential to provide personalised information tailored to the individual or route they are travelling. Key to this personalisation is understanding the audience and their needs. This study sought to explore how, and at what level, transit riders utilise real-time travel information from the social media sites maintained by the transit agency. An online questionnaire was used to collect data about the transit agency's social media users, these data were evaluated using Principal Component Analysis (PCA) and cross tabulation analysis.

Perhaps not surprisingly, there is a significant relationship between respondents' age and their travel purpose. Across age groups and across travel purposes the vast majority of respondents said they most commonly check the transit agency's social media pages, "before journey," to gather daily updates prior to starting their journeys. Thus, the social media sites already have the potential to influence the users' travel plans before their journey, such as changing their route, travel mode, and/or departure time. On the other hand, this outcome indicates that an active engagement with social media is still missing from the viewpoint of customers. The fact that there are so many users that visit the social media pages for trip planning there is an opportunity to reach these individuals and provide a much more dynamic engagement. While the focus is on a single transit agency, most of the results transcend the specific location or agency.

Keywords: Social Media, Transit Services, Passenger Engagement, Travel Disruption, Principal Component Analysis (PCA)

INTRODUCTION

The Internet and developments in online technology have changed the way we live today, leading to a large shift in the way information can be accessed and an increase in channels open for customer communication. A key reason for this change is the creation of social media and the mass take up of the technology worldwide (1). Access to information is very important for all public services. As a result, public transit agencies are undergoing increasing pressure to engage with their customers who are consuming information beyond traditional media (2).

Traditionally transit information was provided in the form of static information such as timetables in leaflets, booklets or signage at stops and stations (3), but this began to rapidly change with the widespread adoption of the Internet, and related information and communication technologies. Transit information is an important resource for passengers to plan their journeys, and many transit agencies view this information as a major factor in attracting people to switch to public transport (4-5). Today many transit agencies supply transport information tailored to multiple audiences, over a variety of different channels. Generally, passengers require different types of information depending upon the stage of their journey (5-6). For example, real time information is often of great value to travellers during disruptions to service (7). To reduce traveller frustration and reassure passengers, the disruptions must be managed effectively, and information must be clear and concise for passengers to feel in control (8-10). During a disruption passengers have expressed that they would like information quickly, i.e., passengers are favouring real time information (11).

By using social media, transit agencies can benefit from communicating more efficiently with their customer base, thereby saving money and resources when compared to traditional communication methods (12-13). Many transit agencies in the UK have established a presence on social media networks as a means of disseminating operational information and conversing with passengers to maintain customer satisfaction and resolve complaints. The way that each traveller uses the information available from social media websites will vary across the population, some may use the information only as a source of knowledge and others may consume the information in a useful way for actively planning their journeys. The study presented herein used a survey and subsequent analysis to investigate the efficacy of one such social media outreach program by Tyne and Wear Metro (henceforth "TW-Metro"), operator of a light rail transit network, but the results are also of general relevance to other forms of online presence and for transit agencies of all modes. The paper uses TW-Metro customers' engagement and consumption related attributes together with other socio-demographic and journey related characteristics. The study investigates how, and at what level, the TW-Metro users utilise real-time travel information from TW-Metro social media pages on Facebook and Twitter.

The paper starts with a critical review of relevant literature. This is followed by the details of the data collection process, data analysis and discussion of the results. The final section summarises the research findings.

Literature Review

This section provides background to place the work in context. The review covers transit disruptions with an emphasis on communicating the information to the travellers, change through technology, and transit agencies adoption of social media.

Transit Disruption and Information Provision to Customers

Transit disruptions are categorised in the literature as disruption to infrastructure and disruption to the operation of the transport system (14-15). Disruption to public transit prevents an individual from making their journey from an origin to a destination when or as they had planned; thus, having a cascading effect on the individual's planned activities at their destination. Customers want to feel in control of their travel but the lack of information and the limited understanding of how to interpret the information during a disruption are major factors causing customers to feel frustrated (8, 10, 16). Ambrosino et al. (17) note that there is a link between travel disruption and passenger information, with the availability of information stimulating confidence about the journey, and having the potential to result in setting up alternative plans during disruptions. Community of Metros (7) explains that information required during a disruption is complex and goes beyond simply announcing that there is a delay. During a disruption passengers can be affected in different ways depending on their involvement or level of experience (18). Different messages will be required depending upon the stage of the individual's journey and involvement in the disruption, as this can affect different travel decisions. For example, potential customers about to begin their trips may acknowledge information regarding their planned journey and take an alternative route or take a different mode, whilst those directly involved are more likely to desire information regarding a solution (7).

Change Through Technology

Intelligent Transport Systems have created a major technological shift in transportation (19). The Internet without a doubt is the fastest growing information channel and the wholesale adoption of mobile devices, combined with online communication networks, is rapidly changing the information exchange paradigm once more (20). The ability to have an instant connection anytime, anywhere on the go is blurring the lines between people's online and offline lives (10). 70% of UK adults regularly carry smartphones, and more than half (57%) of all Internet users who ever go online to look at social media sites or apps say they 'mostly' do so through a smartphone (21).

A social media is defined by Boyd and Ellison (22) as a web-based service that allows individuals to create a public profile, identify a number of consumers and businesses they share a connection with, plus view activity and converse with those people. Facebook is a social media site and is defined as a social utility that aims to connect people and let them discover what is happening in the world (23). As Facebook is a closed network, it is assumed that people are proactive in joining a community within Facebook they are interested in, or in this case a transport service (10). Twitter on the other hand is an open network, where all content is open to the public and anybody can get involved in the conversation (24). The social media sites of Facebook and Twitter are fast growing online outlets that facilitate real time interaction (23). In 2016, Facebook had 1.5 billion monthly active visitors worldwide and 31 million of those are in the UK, Twitter figures show 15 million monthly active visitors in the UK (25).

Transit Agencies Adoption of Social Media

Transit agencies have sought to keep up with advances in information technology by offering more passenger-centric services (19). They are creating official social media pages to update customers about operations and any service disruption throughout the day (24, 26). Baird and Parasnis (27) state that social media networks are where people (i.e., potential transit customers) are congregating and understandably where businesses want to have a presence. Clifton (26) states that although transport providers have begun to engage with passengers through social media, some are making better use of it than others. Clifton also

suggested that the better feeds are those that have the right balance of information without overloading the followers' feed; they are manned with real people who seem to know when it is appropriate to joke and when a serious attitude is needed. Due to very limited research in the effectiveness of social media in transport, from a customer point of view it is very difficult to measure what is best practice. It is well observed that public services have been slow off the blocks when it comes to social media, therefore specific guidance and understanding of the best practices for the sector have also been slow in coming, with many public services deciding to avoid risk that can occur with social media use.

CASE STUDY – TYNE AND WEAR METRO

The study presented herein aims at exploring how the riders on the TW-Metro utilised the Twitter and Facebook sites maintained by the transit agency; however, as discussed below, the findings transcend the specific transit agency and the specific social media outlets.

The TW-Metro is a light rail system in North East England; It serves Tyne and Wear region covering its five districts, Newcastle upon Tyne, Gateshead, South Tyneside, North Tyneside and Sunderland. It was Britain's first light rapid transit system and the heart of an integrated transport network in North East England (28); On the other hand, it is considered as the second-largest of the four metro systems in the UK, after the London Underground; the others being the Docklands Light Railway and the Glasgow Subway. The TW-Metro opened to the public in August 1980. Some extensions to the original network were opened in 1991 and 2002; At present the network covers 77.5 km and has two lines with a total of 60 stations, nine of which are underground (29). In 2016-17, ridership numbers of TW-Metro users was estimated as 37.2 million passengers per annum (30). In the last 10 years, the patronage has fluctuated between 36 million and 41 million passengers.

In mid-1990s TW-Metro pioneered mobile phone connectivity in its tunnels and was the first railway in Britain to play classical music at stations to improve the passenger waiting environment (28). At present, TW- Metro does not have a technology set up to transmit real time information to the metro users by means of digital and handheld devices. However, there are mobile applications to provide timetable information. Beyond this the other traveller information services include radio and online media stations which broadcast social media updates, on-station information systems including *Passenger Information Displays* which have a real-time feed from the track circuits, and *Passenger Announcements* which are either automated in real time or can be supplemented by a bespoke announcement from the TW-Metro Control Centre.

According to the NEXUS Public Transport Executive (PTE) which owns and manages TW-Metro, the further development of social media services, for example TW-Metro Twitter and Facebook pages, is their current focus as it may allow to address the gap in lack of delivery of real time information to some extent while maintaining better and closer interaction with TW-Metro users. The number of updates made every day is predominantly driven by the performance of the system, for example on a day where there were no disruptions there would only be 2-3 service updates per day. With 450 train services per day mean that there may be a daily occurrence or an incident ranging from slight delays to major disruptions. Therefore the frequency of information updates on the Facebook and Twitter will be highly dependent on the status of the service. As reported by the NEXUS PTE, the growing use of social media by the TW-Metro users has led them to invest in a dedicated staff resource to provide updates and answer questions and queries. This is usually one person on duty through the core of the operational day during 07:00-21:00 though staff will work longer hours where there is a need. This focus has increased the number of updates, as the staff is

now able to provide more detailed and frequent updates during a major incident. It has also improved the response time where the staff members on duty are almost always able to respond to a post within one hour, but usually much quicker. The NEXUS PTE's view is that they now prioritise Twitter as a medium because the chronology of the user interface means it is much easier for a customer to see the latest information in comparison to Facebook posts.

DATA COLLECTION

The survey was developed to collect data in order to investigate the use of social media by TW-Metro passengers for their journey planning process and also to identify future expansion of communication channels between the transit agency and the customers to provide better customer satisfaction, enhanced trust and increased demand for the TW-Metro service.

Questionnaire Survey and Data Collection

A comprehensive online survey was designed, giving due attention to the findings from the literature review, and implemented with the intention of collecting an adequate sample for analysing social media as a communication channel. The survey was published on the TW-Metro social media pages of Facebook and Twitter through the TW-Metro marketing department. The respondents were encouraged to share the survey link with others and the survey was open for 6 weeks in total. It is fairly common in recent years that questionnaire surveys are posted on social media websites; however, it has been reported that 60% of the questions in questionnaires of this sort are usually unanswered by the respondents (31). From the initial set of 450 submitted surveys, 210 were excluded due to missing/incomplete values in at least one of the socio-demographic, journey related and social media usage related categories; yielding, altogether, a final sample size of 240 respondents. The sample represented roughly 1% of TW-Metro social media users at the time of the survey in 2013 (13,247 Facebook followers and 16,027 Twitter followers). It was reported by the NEXUS PTE that number of Twitter followers has increased to 111,035 and Facebook to 39,222 since June 2016 after TW-Metro introduced the dedicated staff resource.

The initial part of the survey included general elements of social media use in general and participants' awareness/opinions of the TW-Metro pages in particular. It included frequency of visits to the TW-Metro social media pages and the use of the pages as a channel of communication. The main emphasis was to collect information from users of the TW-Metro social media pages and the majority of the questions were designed to target this group. The final portion of the survey asked about travel habits and demographic information. The survey design incorporated skip-logic to ensure participants were guided through the survey based on the answers to their previous question.

Descriptive Analysis of the Data

The survey responses were analysed to develop an understanding of the data composition in terms of general social media use, awareness of the TW-Metro social media pages and visit of these pages. According to the dataset, 93% of the respondents were aware of the TW-Metro social media pages (this high level of awareness makes sense given the method of survey implementation). However, Figure 1 shows that the fraction of respondents that visit the TW-Metro social media pages regularly (3 or more times per week) is much lower, at only 40%, with almost 14% of the sample never visiting the TW-Metro social media pages at all. These numbers shift when accounting for riding frequency. Among the riders that travel 3 or more times per week, 57% check the TW-Metro social media pages at least 3 times per week; of the remaining responses that reported riding on TW-Metro at all, 52% checked the TW-Metro

social media pages at least as frequently as they travel on TW-Metro. Regardless, although these respondents are aware of the social media pages, many do not seem to visit or use them.

Excluding the 14% who never visit the TW-Metro social media pages (and thus, were not asked about the following), the survey asked which single stage is the most common stage of the journey they check the pages for service information. Figure 2(a) shows that the most frequent choice was, *before the start of the journey* (61%), which was followed by, *only if the journey is disrupted* (21%). The majority of respondents found the social media pages most useful for planning their journey, e.g., to plan accordingly in the event of any delays or disruptions to service, before leaving home. Since the users had to only choose one of five options, it is likely that most will check the social media pages under the other conditions beyond their single most common, but the survey did not ask about such secondary activities.

In terms of demographic profile across all 207 respondents who use the TW-Metro social media pages, Figure 2(b) shows that the two largest groups of respondents were aged 16-24 (37%) and 25-44 (50%), with a smaller number of responses received by 45-64 year olds (14%). This distribution reflects the tendencies of each age group to use social media rather than the distribution of the TW-Metro ridership. For instance, the shares provided by the NEXUS PTE in terms of journey purpose (40% for work, 20% for education and 40% leisure). According to the ridership statistics, adult share (85-90%) is considerably high compared to child share (10-15%) during 2011-13 (39).

The survey asked the main purpose for using the TW-Metro, as shown in Figure 2(c), 60% reported they primarily travelled for work, with the other three options making up the remainder. Finally, Figure 2(d) shows the breakdown of how frequent the respondents used the metro, with almost half of the users reporting 5+ times per week.

ANALYSIS

This section uses Principal Component Analysis (PCA) followed by cross-tabulation analysis to identify interrelationships that emerge from the survey data. Each of these steps are presented in detail below. The goal is to gain an in depth understanding of TW-Metro users and their use of TW-Metro social media pages.

Principal Component Analysis

To explore the relationships among the variables and to understand the data structure better, a dimension reduction process was conducted. The dataset collected for the study covers a variety of information that is related to the context of social media including the frequency, and the purpose of use, in addition to socio-demographic variables. A Principal Component Analysis (PCA) was selected to reduce the number of observed variables to a smaller number of principal components which account for most of the variance of the observed variables (32). In other words, the main purpose of this form of analysis is to determine if a large group of variables can be adequately explained by a smaller number of unobserved constructs, referred to as factors.

The Principal Component Analysis (PCA) specification follows some specified types of rotation methods, with the constructs being identified based on those that exceed an eigenvalue of one. Meanwhile, the initial output is subjected to rotation which alters the axis position with the aim of making the output clearer, more pronounced and thus, further revealing the embedded structure. Tabachnick et al. (33) suggested that the commonly used criterion of rotation selection for factor analysis is that if any of the absolute value of factor correlation matrix is greater than 0.32, "Promax" rotation should be selected. In contrast, if

the absolute value is smaller than 0.32, “Varimax” rotation should be selected. Meanwhile, “Promax” rotation is recommended first in order to identify the absolute value of factor correlation matrix. Factor correlation matrix shows that the absolute value of the correlation between two factors considered in the analysis is 0.61, and since that is greater than 0.32, the “Promax” method was selected for the factor analysis.

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy alongside Bartlett’s test of sphericity is calculated to consider whether the variables are suitable for structure detection (34-35). Sarstedt and Mooi (36) guided that KMO less than 0.5 is unacceptable of sampling adequacy and over 0.80 is meritorious for adequacy of the correlations. To evaluate the reliability of the factors identified in the PCA, Cronbach’s alpha is calculated to consider the internal consistency of the grouped statements (37). Table 1 presents the output from the principal component analysis of those variables measuring respondents’ perceptions about TW-Metro social media services.

According to the results, the KMO was turned out as 0.84, which is in the very good range, showing adequacy of the correlations. Exploring the output of the PCA, three factors have been identified to represent metro user perceptions towards the social media services: “daily information update”, “customer service indicator”, and “disruption information update”. Factor 1 (daily information update) includes four statements based on the number of updates as well as the usefulness, clarity and relevance related aspects. Three main statements together explain Factor 2 (customer service indicator); they include Facebook and Twitter users’ satisfaction in terms of time taken to respond, how relevant the response was, as well as the way that the response was written. Factor 3 (disruption information update) is composed of 3 statements that make the customers aware of the situation in case of disruption, especially in terms of advance notice for them to plan for an alternative to the journey that has already been disrupted. Peterson (38) indicated that the acceptable alpha scores range from 0.5 for preliminary analysis to 0.9 for applied research. In this paper, Cronbach’s alpha has been calculated for each factor identified in the analysis. The Cronbach’s alpha values are 0.93, 0.99 and 0.94, all falling above the threshold, indicating a high level of reliability.

Cross-tabulation Analysis

Cross tabulation is very useful when examining relationships within a dataset that might not be readily apparent when analysing total survey responses. The other advantage is that it provides a way of analysing and comparing the outcomes for one or more variables with the outcome of another variable(s). The purpose of using the cross-tabulation analysis in this study was to investigate the relationship between travellers’ age, travel purpose and the level of usage to social media travel feeds. The outcome of cross tabulation analysis was aimed to test the following hypotheses using a Chi-square test (recall that the survey asked which single stage is the most common stage of the journey they check the pages for service information):

- H1 there is a significant relationship between respondents’ age and their main travel purpose
- H2 there is a significant relationship between respondents’ main travel purpose and the frequency of checking the TW-Metro social media pages
- H3 there is a significant relationship between respondents’ age and the most common stage of the journey when they check the TW-Metro social media pages
- H4 there is a significant relationship between respondents’ main travel purpose and the most common stage of the journey when they check the TW-Metro social media pages

Figure 3(a) shows that respondents belonging to the age groups 16-24 and 25-44 mainly used Metro for education and work purposes, respectively. Chi-square test was used to test the hypotheses H1 with a resulting p-value of 0.00, indicating that there is a significant relationship between respondents' age and their travel purpose. Upon testing H2, correlation between respondents' main travel purpose and their frequency of checking the TW-Metro social media pages, no significant relationship was found based on the p-value (0.06). The failure to detect a significant relationship may be due to the way that the age groups were proposed in the questionnaire design. For example, the structure of the age groups will include a mix of students/professionals or professionals/retirees. Figure 3(b) shows that those who travel for leisure/shopping check the TW-Metro Facebook/Twitter feed 1-2 times per week, and that makes sense given the usual frequency of shopping activity is 1-2 times per week in general [a recent survey in the UK reported that 78% of the population belong to this category (39)]. Whereas, respondents who travel for educational purposes and for work purposes check the TW-Metro Twitter/Facebook feed at 3-4 times per week and 5+ times per week respectively.

There is a significant relationship that exists between respondents' age and the stage of the journey that they check TW-Metro Twitter/Facebook feed as the resulting p-value of Chi-square test is 0.03. Figure 3(c) clearly shows that respondents check the TW-Metro Twitter/Facebook feeds before starting the journey across all age groups; while Figure 3(d) shows a similar trend across all three travel purposes. This indicates that the Facebook and Twitter feeds have the potential to change TW-Metro users' travel plans before their journey, such as changing their travel time, route or travel mode. However, respondents who travelled mainly for educational purposes seemed to be checking Twitter/Facebook feeds whilst they are waiting at the station during transit. As the p-value of the Chi-square test is greater than 0.05, there is no particular correlation detected, and therefore H4 is rejected. However additional granularity when forming the age groups as well as securing some vital information regarding the statuses of the users, e.g., using "students", "professionals," and "retired persons," in the questionnaire design might have proven more useful when drawing insights for further discussions on H3 and H4.

DISCUSSION AND CONCLUSIONS

This study investigated the uses of social media for travel planning on a transit system with particular attention to travel disruptions and delays. Social media and other on-line services can provide general system information at low costs compared to other media. More importantly, rather than having a one-size-fits all traveller information system, these on-line services have the potential to provide personalised information tailored to the individual or route they are traveling. Key to this personalisation is understanding the audience and their needs. The study was conducted on the TW-Metro system in Tyne and Wear, UK, but most of the results transcend the specific location or transit agency. The core of this study was a survey to explore how, and at what level, TW-Metro users utilise real-time travel information from the social media sites maintained by TW-Metro.

The original survey recruited participants via the TW-Metro social media sites, so the results cannot be used to compare different sources of information, e.g., via the TW-Metro web page or sites that integrate information across different transit operators (e.g., TW-Metro does not operate buses, but there are a number of travel planning sites that integrate TW-Metro and bus trips for the purpose of travel planning in the Tyne and Wear region). While 93% of the respondents were aware of the TW-Metro social media pages, only 40% visit them at least 3 times per week and roughly 14% never visit them at all. The numbers increase

somewhat after accounting for frequency of travel on TW-Metro, but never climb above 57%. Since most of the questions in the survey assumed regular use of social media, the 14% that never visit the TW-Metro social media sites were excluded from further processing. Presumably some of these users were lost to other information services, e.g., TW-Metro's own web page. Across the demographic groups the 16-24 year olds and those commuting for education showed the greatest engagement with the TW-Metro social media sites. This result is not surprising since these groups also represent a larger share of social media consumers.

The vast majority of respondents primarily checked the social media sites to gather daily updates prior to starting their journeys and this fact was true across all of the demographic groups. Thus, the TW-Metro social media sites already have the potential influence the users' travel plans before their journey, such as changing their route, travel mode, and/or departure time. Meanwhile, less than 30% of the respondents sought more information related to disruptions and delays beyond the pre-trip forecasts. This outcome indicates that an active engagement with social media is still missing from the viewpoint of customers. At least part of this social media drop off after the trip planning stage reflects the fact that the TW-Metro system has up to date active message signs in the stations and audible announcements throughout the system to inform travellers about any delays or disruptions. For transit systems that do not have such standalone communication infrastructure (e.g., most bus systems), there is the potential for even greater traveller engagement with the ultimate goal of improving user satisfaction.

On the other hand, the fact that there are so many users that visit the social media pages for trip planning there is an opportunity to reach these individuals and provide a much more dynamic engagement. Possible examples that would add this value include allowing users to create profiles to list their preferred routes or simply providing information about transit vehicles approaching the user's location. Of course, if these backend tools are developed the interface should not be limited to social media sites that may require login, to have the greatest impact any customised traveller information should also be accessible on the web or through a smart phone app.

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Study conception and design: Joanne Douglass: 70%, Dilum Dissanayake: 30%;

Data collection: Joanne Douglass: 80%, Dilum Dissanayake: 20%;

Analysis and interpretation of results: Joanne Douglass: 40%, Dilum Dissanayake: 20%; Benjamin Coifman: 20%, Weijia Chen: 10%, Fazilatulaili Ali: 10%

Draft manuscript preparation: Joanne Douglass: 40%, Dilum Dissanayake: 20%; Benjamin Coifman: 20%, Weijia Chen: 10%, Fazilatulaili Ali: 10%

REFERENCES

1. Ofcom (2008) *Social Networking Report*. [Online].
<http://stakeholders.ofcom.org.uk/binaries/research/media-literacy/report1.pdf>.
2. Smith, K. (2013) *Taming the social media beast*.
<http://www.railjournal.com/index.php/blogs/kevin-smith/taming-the-social-media-beast.html>
3. CILT (2006) *Getting the Info on Passenger Information Systems*. www.ciltuk.org.uk.
4. Beck, M.J. and Rose, J.M. (2016) 'The best of times and the worst of times: A new best–worst measure of attitudes toward public transport experiences', *Transportation Research Part A: Policy and Practice*, 86, pp. 108-123.
5. Tyne and Wear Local Transport Plan (TWLTP) (2011) *Keep Tyne and Wear Moving LTP3: The Third Local Transport Plan for Tyne and Wear Strategy 2011-2021*.
<http://www.tyneandwearltp.gov.uk/wp-content/uploads/2011/04/TW-LTP3-Strategy-Mar-2011-for-upload.pdf>.
6. Grotenhuis, J.-W., Wiegman, B.W. and Rietveld, P. (2007) 'The desired quality of integrated multimodal travel information in public transport: Customer needs for time and effort savings', *Transport Policy*, 14(1), pp. 27-38.
7. Community of Metros (CoMET) (2011) *Community of Metros Case Study 2010: Information During Disruptions Final Report*. Imperial College London.
8. Beirão, G. and Sarsfield Cabral, J.A. (2007) 'Understanding attitudes towards public transport and private car: A qualitative study', *Transport Policy*, 14(6), pp. 478-489.
9. Bluegrass (2012) *DB Regio Tyne and Wear Communication Service Disruption Focus Group Findings*. Bluegrass, N.u.T.
10. Transport Focus (2012) *The Future of Transport*.
11. Nexus (2013) 'Metro Strategy 2030 Background Information'
<http://www.nexus.org.uk/sites/default/files/Metro%20Strategy%20Background%20document.pdf>
12. Kuzma, J. (2010) 'Asian government usage of Web 2.0 social media', *European Journal ePractice*, pp. 1-13.
13. Landsbergen, D. (2010) 'Government as part of the revolution: Using social media to achieve public goals', *Electronics Journal of e-Government*, 8(2), pp. 135-147.
14. Cairns, S., Aitkins, S. and Goodwin, P.G. (2002) Disappearing Traffic? The story so far, *Proceedings of the Institution of Civil Engineers; Municipal Engineer* 151 (1), 13-22.
15. Van Excel, N. and Reitveld, P. (2001) 'Public Transport strikes and travel behaviour', *Transport Policy*, 8, pp. 237-246.
16. Caulfield, B., O'Mahony, M. and Farrell, S. (2005) 'An Examination of the Public Transport Information', *IEEE Conference on Intelligent Transportation Systems*. Vienna, Austria.
17. Ambrosino, G., Nelson, J.D. and Romanazzo, M. (2004) *Rome: ENEA*.
18. Iryo, T., Yamabe, K. and Asakura, Y. (2012) 'Dynamics of information generation and transmissions through a social network in non-recurrent transport behaviour', *Transportation Research Part C: Emerging Technologies*, 20(1), pp. 236-251.
19. Camacho, T.D., Foth, M. and Rakotonirainy, A. (2012) 'Pervasive Technology and Public Transport: Opportunities Beyond Telematics', 21(1)
<http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6336696>.
20. Nunes, A.A., Galvao, T., Falcão e Cunha, J. and Pitt, J.V. (2011) 'Using Social Networks for Exchanging Valuable Real Time Public Transport Information among Travellers', pp. 365-370.

21. Ofcom (2016) *Adult media use and attitudes*.
<http://stakeholders.ofcom.org.uk/binaries/research/media-literacy/adults-literacy-2016/2016-Adults-media-use-and-attitudes.pdf>
22. Boyd, d.m. and Ellison, N.B. (2007) 'Social Network Sites: Definition, History, and Scholarship', *Journal of Computer-Mediated Communication*, 13(1), pp. 210-230.
23. Facebook (2014) *News Room*. <http://newsroom.fb.com/company-info/>.
24. Austin, J., 2013. Use of Social Networking to promote public transport and sustainable travel. [Online]. Available at:
[http://www.analytics.co.uk/resources/Use+of+Social+Media+to+promote+PT+\\$26+Sustainable+Travel.pdf](http://www.analytics.co.uk/resources/Use+of+Social+Media+to+promote+PT+$26+Sustainable+Travel.pdf) [Accessed 21 June 2013]
25. Social, A. (2016) *The Latest UK Social Media Statistics for 2016*.
<http://avocadosocial.com/1095-2/>.
26. Clifton, P. (2011) 'Watch the Birdie.', *Rail Professional Magazine*.
27. Baird, C. H., and Parasnis, G., (2011). *From Social Media to Social Customer Relationship Management*, Strategy & Leadership, Vol. 39 Iss: 5, pp.30 – 37.
28. Quintly (2014) Response Rates By Facebook Pages kept growing in 2014
<https://www.quintly.com/blog/2015/01/response-rates-facebook-pages-2014/>
29. Suhr D. D. (2016) Principal Component Analysis (PCA) Vs Exploratory Factor Analysis (EFA), www2.sas.com/proceedings/sugi30/203-30.pdf
30. Tabachnick, Barbara, G., Fidell, L.S. and Osterlind, S.J. (2001) *Using multivariate Statistics*.
31. Bartlett M. S. (1950) 'Tests of significance in factor analysis', *British Journal of Statistical Psychology*, 3(2), pp. 77-85.
32. Hotelling and Harold (1933) 'Analysis of a complex of statistical variables into principal components', *Journal of education psychology*, 24(6), p. 417.
33. Sarstedt, M. and Mooi, E. (2014) *A concise guide to market research: the process, data, and methods using IBM SPSS statistics*. Springer.
34. Cronbach and J., L. (1951) 'Coefficient alpha and the internal structure of tests.', *Psychometrika*, 16(3), pp. 297-334.
35. Peterson, R.A. (1994) 'A meta-analysis of Cronbach's coefficient alpha', *Journal of consumer research*, pp. 381-391.
36. Valued Opinions Survey (2016)
<https://www.valuedopinions.co.uk/news/details/article/423-42-of-people-visit-a-supermarket-once-a-week/>
37. Neuxs (2017) 'How Metro was built', <https://www.nexus.org.uk/history/how-metro-was-built>
38. Nexus (2017) 'Tyne and Wear metro routes', <http://www.thetrams.co.uk/tyneandwear/routes.php>
39. Nexus (2013) 'Nexus Strategic Intelligence Report 2012-13',
[https://www.nexus.org.uk/sites/default/files/Strategic%20Intelligence%20Report%202012-13%20\(Alex%20Finkel\).pdf](https://www.nexus.org.uk/sites/default/files/Strategic%20Intelligence%20Report%202012-13%20(Alex%20Finkel).pdf)

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FIGURE 1 Database statistics.

FIGURE 2 Descriptive statistics of the TW-Metro social media users - percentage frequencies.

FIGURE 3 Segmented percentage distributions.

- (a) Respondents' age and main travel purpose,
- (b) Respondents' frequency of checking the TW-Metro social media pages and main travel purpose,
- (c) Respondents' age and the stage of the journey where they are most likely to check the TW-Metro social media pages,
- (d) Respondents' main travel purpose and the stage of the journey they check TW-Metro Twitter/Facebook feed

TABLE 1 Output from the Principal Component Analysis - Respondents' Perceptions and Usage Habits of TW-Metro Social Media Services

Statement	C	M	SD
<i>Factor 1 Daily information update (α: 0.930)</i>			
TW-Metro Facebook and Twitter provides me with a satisfactory number of updates in a day	0.18	3.40	1.58
TW-Metro Facebook and Twitter posts are written in a friendly yet professional manner	0.50	3.60	1.62
I understand the terms of TW-Metro used to define any disruption (minor/major)	0.16	3.41	1.66
TW-Metro Facebook and Twitter provides me with an instant reason for a disruption	0.18	3.06	1.63
<i>Factor 2 Customer service indicator (α: 0.986)</i>			
Time taken to receive a reply	0.20	0.61	1.39
Relevance of the answer to your question	0.44	0.68	1.52
Manner/Friendliness of the written response	0.37	0.75	1.63
<i>Factor 3 Disruption information updates (α: 0.936)</i>			
I am given enough notice prior to a closure through TW-Metro Facebook and Twitter	0.56	3.73	1.39
The information provided by TW-Metro Facebook and Twitter is satisfactory for me to plan an alternative journey	0.09	3.60	1.37
Enough reminders about the closure are provided through TW-Metro Facebook and Twitter updates	0.35	3.73	1.32
<i>KMO: 0.84</i>			

Notes:

KMO: Kaiser-Meyer-Olkin; α : Cronbach's alpha; C: coefficient; M: mean; and SD: standard deviation