Woo Bikes: Promoting Bike Sharing at the University and City of Worcester

An Interactive Qualifying Project
Kyra Bresnahan, Harold Hearst, Erika Sanborn, Andrew Sheridan
Sponsored by Katy Boom, University of Worcester Sustainability Department
April 27, 2019
Woo Bikes: Promoting Bike Sharing at the University and City of Worcester
An Interactive Qualifying Project
submitted to the Faculty of WORCESTER POLYTECHNIC INSTITUTE
in partial fulfilment of the requirements for the degree of Bachelor of Science

by
Kyra Bresnahan
Harold Hearst
Erika Sanborn
Andrew Sheridan

Date:
27 April 2019

Report Submitted to:
Katy Boom
University of Worcester

Professor Dominic Golding
Worcester Polytechnic Institute

This report represents work of WPI undergraduate students submitted to the faculty as evidence of a degree requirement. WPI routinely publishes these reports on its web site without editorial or peer review. For more information about the projects program at WPI, see http://www.wpi.edu/Academics/Projects.
Abstract

The team collaborated with the Sustainability Department at the University of Worcester to determine ways to increase the uptake of bike sharing both at the university and in the city of Worcester, England. This was accomplished by gathering current opinions of university staff and students regarding cycling as well as interviewing bike share stakeholders about best practices. Additionally, the team worked with West Midlands Trains and Stack Rack Bicycles to develop a promotional plan for the Stack Rack Bicycles last mile travel initiative, which allows commuters to book out a bike for a day from their destination train station.
Acknowledgements

We would like to thank the many individuals who contributed assistance throughout our project. Thank you to our IQP advisor, Dominic Golding, for his continued support and helpful guidance. We would also like to thank Katy Boom and Naomi Goldman for their support with all things Woo Bikes. Additional thanks to Dr. Charles Carey, Jon Harris and Jack Brown for their help with the Stack Rack Bicycles side of our project.

We would also like to thank Tom Piotrowski from Fortis Living, Mark Radford from Worcester City Council, Henry Harbord from Worcestershire County Council, Antonia Roberts from CoMo UK, and Peter McDonald from Croydon Council for their assistance with obtaining the information we needed. Thank you as well to Robert Krueger for directing the project center. Lastly, we would like to extend our gratitude to the University of Worcester for providing us with an excellent project center at which to live and work.
Executive Summary

Bike sharing programs provide a convenient, healthy and environmentally friendly form of travel without having to commit large amounts of money. They allow users to rent a bicycle for a brief period in order to get between locations. As of 2018, 71 countries had implemented at least one bike share program and the global fleet had grown to more than 4.5 million bicycles (Roland Berger, 2018; Fishman & Schepers, 2018).

Bike share programs have grown in number and size in the last 25 years because of the variety of benefits that they provide to users and the cities and towns in which they are located. Cycling has a variety of health benefits, including lowering the risk of cardiovascular disease (Celis-Morales et al., 2017). Increasing the amount of bicycle travel also reduces the number of cars on the roads, therefore helping to alleviate traffic congestion and reduce carbon emissions (Metz, Davidson, Bosch, Dave, & Meyer, 2007). Another major selling point for bike shares is that they provide “last mile” transportation for commuters (Midgley, 2013). This implies that a bike share user would use some other method of travel primarily and then use a rented bike to complete the last leg of their journey.

Examples of past and present bike shares have found that preventing theft and vandalism as well as providing adequate docking and tracking are necessary for a scheme to succeed. However, many other factors contribute towards deciding the fate of a bike share. These factors include bicycle infrastructure, public attitudes toward cycling, and population density.

The University of Worcester has its own bike sharing system, Woo Bikes, which the university’s Department of Sustainability administers. Woo Bikes allows students and employees to pay a modest annual fee in order to use a bicycle anytime they wish. The Woo Bikes scheme has been quite successful, but the university hopes that the scheme will become more popular with the recent introduction of electric bikes (e-bikes). The university is also collaborating with Stack Rack Bicycles and West Midlands Trains to explore the desirability of the Stack Rack Bicycles initiative, a new scheme that that would place innovative bicycle racks in Worcester.
train stations for commuters to rent bikes for their last mile of travel. Finally, the university is collaborating with local employers to help set up electric bike pools for employees to utilize.

The primary goal of this project was to identify ways to increase the adoption and use of bike sharing in the City of Worcester and at the University of Worcester. In order to achieve this goal, we completed the following objectives:

- Evaluated best practices in promoting and managing bike share schemes in the UK, specifically schemes with e-bikes
- Assessed the barriers to and opportunities for the adoption of bike share schemes among selected large employers in Worcester
- Assessed the attitudes of students at the University of Worcester toward cycling and bike share schemes, and especially the use of e-bikes
- Gauged interest in and concerns about the adoption of Stack Rack Bicycles in Worcester
- Conducted events to promote the adoption and use of bike sharing in Worcester

We accomplished the first objective by reviewing university staff and student travel survey data as well as by interviewing stakeholders in nearby bike share programs. We completed the second objective by interviewing employers who had either set up or were in the process of setting up a bike pool, in addition to conducting Have-a-Go sessions for employees to try out e-bikes. For the third objective, we interviewed university students about their opinions on cycling as well as what could make them more likely to utilize the Woo Bikes scheme. We completed the fourth objective by distributing surveys to university staff and students about their interest in Stack Rack Bicycles and what their particular use cases for the system would be. Lastly, our fifth objective was accomplished by holding Have-a-Go events both on the university campus and in the city at the university’s Go Green Week event.

Because Have-a-Go sessions on campus drew the majority of participants when held alongside another event and were successful at employers and Go Green Week, we recommend that the Sustainability Department Woo Bikes staff always run Have-a-Go sessions in conjunction with other campus events. We also recommend that the Sustainability Department
should use Have-a-Go sessions as a supplementary promotional method along with other primary efforts. We concluded based on the student travel survey and student interviews that a large percentage of students are not aware of the Woo Bikes program. Therefore, we recommend having more signage advertising the scheme around campus. The electronic advertisement boards in locations such as the Student Union building would be ideal for this, as students will be used to seeing advertisements for student events and programs on these.

Based on our background research as well as some of our employer interviews, we concluded that one of the reasons that employers are not adopting bike pool schemes is because they are unsure about the details of what a bike pool would bring to their company and what kind of work they need to put in to maintain the program. Therefore, we recommend that the Sustainability Department develop a standard media package and manual to give to employers looking to set up their own bike pool programs.

In terms of Stack Rack Bicycles, we recommend to West Midlands Trains, Stack Rack Bicycles, and the Sustainability Department to put racks at both Foregate Station and St. John’s campus based on an overwhelming majority of survey responses indicating these as the primary locations used by both staff and students. Additionally, no racks should be put at Worcester Shrub Hill Station.

As with Woo Bikes, we recommend the Sustainability Department and West Midlands Trains increase the amount of promotional materials on campus advertising Stack Rack Bicycles as a service. Campus wide emails, posted flyers, and video advertisements that play on campus displays are all ways we recommend advertising the services.
## Authorship

<table>
<thead>
<tr>
<th>Section</th>
<th>Authors</th>
<th>Editors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>Drew Sheridan</td>
<td>All</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Executive Summary</td>
<td>All</td>
<td>Kyra Bresnahan, Drew Sheridan, Harold Hearst</td>
</tr>
<tr>
<td>Introduction</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td><strong>Background</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overview</td>
<td>Andrew Sheridan</td>
<td>All</td>
</tr>
<tr>
<td>Successful Bike Shares in Europe</td>
<td>Kyra Bresnahan</td>
<td>All</td>
</tr>
<tr>
<td>Failed Bike Shares in Europe</td>
<td>Harold Hearst</td>
<td>All</td>
</tr>
<tr>
<td>Bike Sharing in the UK</td>
<td>Erika Sanborn</td>
<td>All</td>
</tr>
<tr>
<td>Overcoming Barriers to the Adoption of Bike Sharing</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Worcester Bike Share</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td><strong>Methodology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Objective 1</td>
<td>Harold Hearst, Erika Sanborn</td>
<td>All</td>
</tr>
<tr>
<td>Objective 2</td>
<td>Kyra Bresnahan</td>
<td>All</td>
</tr>
<tr>
<td>Objective 3</td>
<td>Erika Sanborn</td>
<td>All</td>
</tr>
<tr>
<td>Objective 4</td>
<td>Andrew Sheridan</td>
<td>All</td>
</tr>
<tr>
<td>Objective 5</td>
<td>Harold Hearst</td>
<td>All</td>
</tr>
<tr>
<td><strong>Findings</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stakeholder Opinions on the Barriers and Opportunities for Bike Share Programs</td>
<td>Andrew Sheridan</td>
<td>Kyra Bresnahan</td>
</tr>
<tr>
<td>Section</td>
<td>Authors</td>
<td>Editors</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>Perceptions and Promotion of Woo Bikes</td>
<td>Kyra Bresnahan, Erika Sanborn, Andrew Sheridan</td>
<td>Andrew Sheridan, Harold Hearst</td>
</tr>
<tr>
<td>University Staff and Student Opinions about Stack Rack Bicycles</td>
<td>Kyra Bresnahan, Harold Hearst</td>
<td>Andrew Sheridan, Harold Hearst</td>
</tr>
<tr>
<td><strong>Conclusions and Recommendations</strong></td>
<td>Harold Hearst, Erika Sanborn, Andrew Sheridan</td>
<td>Kyra Bresnahan, Harold Hearst</td>
</tr>
</tbody>
</table>
# Table of Contents

Abstract ................................................................................................................. i

Acknowledgements ................................................................................................. ii

Executive Summary ................................................................................................. iii

Authorship ................................................................................................................ vi

Table of Contents ..................................................................................................... viii

Table of Figures ........................................................................................................ xii

Introduction ............................................................................................................. 1

Background ............................................................................................................... 3

Overview .................................................................................................................. 3

Successful Bike Shares in Europe ............................................................................. 6

Failed Bike Shares in Europe ................................................................................... 8

Bike Sharing in the UK ............................................................................................... 9

Overcoming Barriers to the Adoption of Bike Sharing ............................................. 11

The Barriers ............................................................................................................. 11

Overcoming the Barriers ......................................................................................... 12

Worcester Bike Share ............................................................................................... 15

Methodology ............................................................................................................ 17

Objective 1: Evaluated best practices in promoting and managing bike share schemes, specifically schemes with e-bikes .................................................. 19
Objective 2: Assessed the barriers to and opportunities for the adoption of bike schemes among selected large employers in Worcester .................................................. 20

Objective 3: Assessed the attitudes of students at the University of Worcester toward cycling and bike share schemes, and especially the use of e-bikes.......................... 21

Objective 4: Gauged interest in and concerns about the adoption of Stack Rack Bicycles in Worcester................................................................. 22

Interviewing Stakeholders .................................................................................. 22

Gathering Data................................................................................................. 23

Objective 5: Conducted events to promote the adoption and use of bike sharing in Worcester.................................................................................. 24

Findings........................................................................................................ 26

Stakeholder Opinions on the Barriers and Opportunities for Bike Share Programs..... 26

Perceptions and Promotion of Woo Bikes .......................................................... 29

On Campus Perceptions and Promotions......................................................... 30

Off Campus Perceptions and Promotions......................................................... 35

University Staff and Student Opinions about Stack Rack Bicycles ................. 37

Conclusions and Recommendations ............................................................... 40

References..................................................................................................... 43

Appendix 1: Sponsor Description........................................................................ 48

Bibliography .................................................................................................... 52

Appendix 2: Bike Share Program Interview Script ........................................... 53

Preamble ......................................................................................................... 53
Interview Questions ................................................................. 53

Appendix 3: Employer Interview Script .................................................. 54
  Preamble .................................................................................. 54
  Interview Questions ................................................................. 54

Appendix 4: Employer Have-a-Go Survey .................................................. 56
  Preamble .................................................................................. 56
  Survey Questions ...................................................................... 56

Appendix 5: Student Interview Script ......................................................... 58
  Preamble .................................................................................. 58
  Screening Questions .................................................................. 58
  Interview Questions ................................................................. 58
  Follow-up Questions: Riders ...................................................... 59
  Follow-up Questions: Non-riders .............................................. 59

Appendix 6: Stack Rack Bicycles Stakeholder Interviews ......................... 60
  Preamble .................................................................................. 60
  Interview Questions: Dr. Carey ................................................. 60
  Interview Questions: Jon Harris ............................................... 61

Appendix 7: Stack Rack Bicycles Interest Survey ...................................... 62
  Preamble .................................................................................. 62
  Travel Questions ....................................................................... 62
  Demographic Information ......................................................... 64
Appendix 8: Promotional Event Survey for Riders ................................................................. 65

Preamble .................................................................................................................................. 65

Survey Questions ....................................................................................................................... 65

Appendix 9: Promotional Event Survey for Non-riders .......................................................... 67

Preamble .................................................................................................................................. 67

Survey Questions ....................................................................................................................... 67

Appendix 10: Sample Infographic for Managers ................................................................... 69

Appendix 11: Example Employer Manual Outline ................................................................. 70

Appendix 12: Example Stack Rack Bicycles Promotional Flyer .............................................. 71
## Table of Figures

Figure 1: Growth of bicycles available in bike shares from 1995-2017 ...................... 5

Figure 2: The ten cities with the largest bike share systems by number of bicycles observed ........................................................................................................ 6

Figure 3: Reasons cited for not participating in the CityCycle bike share .................. 11

Figure 4: Motivators for using the Melbourne Bike Share and CityCycle programs ... 13

Figure 5: Percentage of respondents who cite the given reasons to use e-bikes as a motivator for themselves ........................................................................... 15

Figure 6: Project goal, objectives, and sub tasks ......................................................... 18

Figure 7: Map of student home postcodes, 2018 .......................................................... 30

Figure 8: Map of staff home postcodes, 2018 ............................................................... 31

Figure 9: Student and staff distances from campus as reported in the 2017 and 2018 travel surveys ........................................................................................................ 32

Figure 10: Flyer used to advertise Have-a-Go sessions .............................................. 33

Figure 11: The Woo Bikes gazebo used in some Have-a-Go sessions ...................... 34

Figure 12: The “Try an e-bike!” sign used in some Have-a-Go sessions ................. 35

Figure 13: Distance from campus reported by student Stack Rack Bicycles survey respondents ............................................................................................................. 38

Figure 14: Distance from campus reported by staff Stack Rack Bicycles survey respondents ............................................................................................................. 38
Introduction

Bike sharing programs provide a convenient, healthy and environmentally friendly form of travel without having to commit large amounts of money. They allow users to rent a bicycle for a brief period in order to get between locations. As of 2018, 71 countries had implemented at least one bike share program and the global fleet had grown to more than 4.5 million bicycles (Roland Berger, 2018; Fishman & Schepers, 2018).

Along with a growing number of bike shares comes a growing number of lessons that can be learned from successes and failures of different schemes. The success of Lyon’s Vélo’v and Milan’s BikeMi demonstrate the importance of innovation and integration with public transportation. Conversely, the failures of Vélib’ Métropole in Paris and oBike in Amsterdam demonstrate the importance of reliability of a program without sacrificing public space and causing a nuisance. Finally, for bike shares specifically in the UK, reliable and convenient schemes such as London’s Santander Cycles and Derby’s eBikes Derby have done well, whereas the dockless systems ofo, oBike and Urbo have all recently withdrawn from the UK (McIntyre & Kollewe, 2019).

The University of Worcester has its own bike sharing system, Woo Bikes, which the university’s Department of Sustainability administers. Woo Bikes allows students and employees to pay a modest annual fee in order to use a bicycle anytime they wish. The Woo Bikes scheme has been quite successful, but the university hopes that the scheme will become more popular with the recent introduction of electric bikes (e-bikes). The university is also collaborating with Stack Rack Bicycles and West Midlands Trains to explore the desirability of the Stack Rack Bicycles initiative, a new scheme that that would place innovative bicycle racks in Worcester train stations for commuters to rent bikes for their last mile of travel. Finally, the university is collaborating with local employers to help set up electric bike pools for employees to utilize.
The primary goal of this project was to identify ways to increase the adoption and use of bike sharing in the City of Worcester and at the University of Worcester. In order to achieve this goal, we completed the following five objectives:

- Evaluated best practices in promoting and managing bike share schemes in the UK, specifically schemes with e-bikes
- Assessed the barriers to and opportunities for the adoption of bike share schemes among selected large employers in Worcester
- Assessed the attitudes of students at the University of Worcester toward cycling and bike share schemes, and especially the use of e-bikes.
- Gauged interest in and concerns about the adoption of Stack Rack Bicycles in Worcester
- Conducted events to promote the adoption and use of bike sharing in Worcester

In order to complete our stated objectives, we completed unobtrusive research, interviewed students and stakeholders in bike sharing programs in both the University of Worcester and elsewhere, and surveyed staff, students, and employees at local businesses. We presented our findings to representatives of the University of Worcester, Stack Rack Bicycles, and West Midlands Trains.
Background

This chapter will discuss bike sharing as a whole and a number of bike share program examples. The first section will provide an overview of bike sharing programs, including their benefits and use cases. It will also provide a brief history of bike sharing and trends that have taken place in recent years. The second section will discuss two examples of successful bike shares in Europe. The third section will follow up on this with three examples of failed European bike shares. The section following focuses specifically on bike share programs in the UK. Following that is a description of barriers to bike sharing programs in general. The chapter concludes with a discussion of the University of Worcester, the city of Worcester, and their bike share programs.

Overview

Bike sharing programs are systems that allow users to rent bicycles from a certain location for a short period and return it to a location within the system’s service area (Pedestrian and Bicycle Information Center, n.d.). In many schemes, members must pick up from and subsequently return bikes to a fixed docking station. In a dockless scheme, users park the bikes wherever they wish at the end of their journey and the next user can pick it up from there.

Bike share programs have grown in number and size in the last 25 years because of the variety of benefits that they provide to users and the cities and towns in which they are located. Cycling has a variety of health benefits, including lowering the risk of cardiovascular disease (Celis-Morales et al., 2017). Additionally, there is strong evidence for adults that active commuting such as cycling contributes to reduced risk of such adverse health conditions as type-2 diabetes, hypertension, and adiposity (Oja et al., 2011). In addition, there is evidence that such active commuting habits bolster overall physical fitness (Oja et al., 2011). Increasing the amount of bicycle travel also reduces the number of cars on the roads, therefore helping to alleviate traffic congestion and reduce carbon emissions (Metz, Davidson, Bosch, Dave, & Meyer, 2007). Another major selling point for bike shares is that they provide “last mile” transportation for
commuters (Midgley, 2013). This implies that a bike share user would use some other method of travel primarily and then use a rented bike to complete the last leg of their journey. For example, a person may commute into the city in which they work via train. They would then use a bike share bicycle to complete their trip to their specific place of work within the city, returning it upon leaving to go back home via the train again.

DeMaio provides a comprehensive review of the history of these programs, which trace their roots back to 1965. The idea for a bike share originated in Amsterdam with a system known as Witte Fietsen (White Bikes). Beginning on July 28, 1965, this “first generation” dockless scheme allowed users to pick up and drop off bikes wherever they pleased. Witte Fietsen ran into serious trouble with destructive behaviors and theft, however, and consequently collapsed in mere days. The concept was revitalized in Denmark in the early 1990s using coin-deposit docking stations, ushering in the so-called “second generation” of bike shares, but theft still proved to be an issue as there was no way to identify the users. Slowly but surely, England, France and Germany began to roll out bike sharing programs in the late 90s and early 2000s, this time utilizing technologies such as magnetic stripe smart cards for identification purposes (DeMaio, 2009).

The “third generation” of bike shares began in France and led to growth in bike share popularity. The Lyon program, known as Vélo’v, started in 2005 and boasted 15,000 members. Paris soon followed suit with their own scheme, Vélib’. This program began in 2007 and grew to include over 20,000 bikes (DeMaio, 2009). Shortly thereafter, the United States gained its own first modern bike share in the form of SmartBikes DC (CityLab, 2018). As of 2018, 71 countries had incorporated bike share systems (Roland Berger, 2018). Electric bikes, or e-bikes, are becoming increasingly popular in bike share schemes. They have grown in number to more than 50,000 since 2009 (Sisson, 2018). Figure 1 shows the skyrocketing popularity of bike share systems in recent years.
As shown in Figure 2, the Vélib’ scheme has made Paris the largest bike sharing city in the world, while Lyon is also in the top ten with Vélo’v. Midgley’s report for the United Nations Department of Economic and Social Affairs declares Vélo’v an innovator in the “Third Generation +” of bike shares. He identifies the Third Generation + as bike shares with GPS trackers on bicycles, applications that allow customers to determine the availability of bicycles at nearby docking stations, and even the addition of electric bicycles to the standard fleet (2011). We shall look more in depth at two of these recent bike shares in the next section.
Successful Bike Shares in Europe

In this section, we examine bike shares operating successfully in Europe to determine factors that contributed to their success.

One such bike sharing system is the aforementioned Vélo’v, which has been operating since May 2005 in the Grand Lyon metropolitan area surrounding the city of Lyon, France (Jensen, Rouquier, Ovtracht, & Robardet, 2010; Vogel et al., 2014). Vélo’v does not currently have electric bicycles; however, its standard bicycles are state-of-the-art. In July 2018, the advertising company JCDecaux, which sponsors the scheme, announced that all 4,000 bicycles had been replaced by brand new bicycles to better serve its 73,000 subscribers (JCDecaux, 2018).

Vogel et al. (2014) found that heavy users of the Vélo’v scheme tend to be young men, but people who use the bike share in conjunction with other forms of transportation tend to be diverse in gender and age. Surprisingly, they found that the user’s place of residence did not

Figure 2: The ten cities with the largest bike share systems by number of bicycles observed (Fishman, 2015)
influence the frequency of use (Vogel et al., 2014). Regular users were distributed throughout the city.

Another successful citywide bicycle system of note in Europe is BikeMi in Milan, Italy. Like Vélo’v, the system is high-tech, including a map of the number of bikes available at each docking station on their website (BikeMI, n.d.). Unlike Vélo’v, the system includes modern electric bicycles. Indeed, the official BikeMi website boasts that “BikeMi is the first example in the world of an integrated Bike sharing system between 3,650 traditional bicycles and 1,150 e-bikes (150 with child seat), unique in terms of size, complexity and innovation” (BikeMI, n.d.). According to Erlandsson and Hägglöf (2016), members can dock all bicycle types at the same docking stations because the stations do not charge e-bike batteries. Instead, company staff pick up and recharge the batteries elsewhere (Erlandsson & Hägglöf, 2016).

In contrast to the Vélo’v system’s younger demographic (Vogel et al., 2014), Saibene and Manzi (2015) found that the average user of BikeMi is closer to middle age and often works in business. In 2017, Saibene and Manzi returned to BikeMi and found that 70% of users were interested in innovations related to e-bikes and GPS tracking. Customer appreciation for the innovative nature of BikeMi has apparently worked in their favor, because 82% of customers agreed, “the BikeMi service is a valid alternative to private car” (Manzi & Saibene, 2017). This statistic is particularly interesting because Milan’s historical center, called Area C, is traffic restricted. At certain times on weekdays, drivers, except drivers of hybrids and other eco-friendly cars, must pay €5 (Area C, n.d.). Therefore, for anyone traveling into Area C, an alternative to cars could be helpful.

While there are some differences to the Vélo’v and BikeMi systems, the systems have some similarities that contribute to their success. Both Vogel et al. (2014) and Manzi and Saibene (2017) noted the successful integration of the system with the local public transportation system. In addition, both official websites take great pride in their real time maps that allow users to find the number of bicycles at local docking stations (Vélo’v, n.d.; BikeMI, n.d.).
Failed Bike Shares in Europe

In this section, we examine some of the less successful bike share schemes in Europe to identify those factors that contribute to their failure.

Vélib’ was one of the biggest bike sharing programs in Paris. Beginning on July 15, 2007, Vélib’ was initially considered a huge success by raising the total number of bikes on the street by 41% (Larsen, 2013). Even in the early years, however, the program was plagued with problems. For example, 8,000 bikes were stolen or went missing and another 16,000 were otherwise vandalized within the first two years (Beardsley, 2009). Nevertheless, the program ran successfully for a decade, under the sponsorship of the advertising corporation JCDecaux. When the contract with JCDecaux expired, the French-Spanish consortium Smovengo signed up to run Vélib for the next 15 years and rebranded the scheme as Vélib’ Métropole. When Vélib’ Métropole launched at the start of 2018, they introduced several high-tech modifications, replacing entirely the old bikes and docking stations. Due to the higher technical specifications of the new bikes and docking stations, however, they were unable to produce and install bikes and stations quickly enough. By April 2018, they were 50% behind their production schedule (Chrisafis, 2018). Due in part to the limited supply of bikes and docking stations as well as technical issues associated with their use, many people found that the biking service was no longer reliable, and Vélib’ Métropole lost 71,000 (24%) of their former 290,000 subscribers (Chrisafis, 2018).

Gobee.bike was an international bike share founded in February 2017. Gobee.bike was located in many different countries including Belgium, France, and Italy. Similarly to the early years of Vélib, there were many cases of vandalism and willful damage to the bicycles, so much so that by February 2018, 60% of the bikes had been vandalized (Adinolfi, 2018), which may have been due to a lack of technology built into the bicycles and docking stations (Midgley, 2011). Due to the high maintenance and replacement costs, Gobee.bike could not maintain a profit and withdrew from many of their locations. The company had a branch in Hong Kong,
which lasted a little bit longer, but still closed down in July 2018 due to the same reasons (Leung, 2018).

oBike is another international bike share. oBike is specifically a dockless bike share. Since users of oBike could simply leave a bicycle anywhere, people would leave them in inappropriate places, causing a nuisance to the city of Amsterdam (Reid, 2017). The negative effects of the abandoned bicycles were enough that the city took action and banned all dockless bicycles in 2017 (Rodenburg, 2017). Amsterdam has revisited this policy and has decided that up to three organizations will be able to apply for a dockless bike share license in March 2019, under certain regulations (Rodenburg, 2017).

Bike Sharing in the UK

In addition to the sample bike share programs previously discussed, we also need to know how bike shares have fared in environments similar to Worcester. For this reason, we researched several bike shares that are located in various cities in the UK.

Like elsewhere in Europe, not all UK bike shares have seen success and warm welcomes. The city of Cambridge appears on the surface to be an excellent location for a bike share, as bicycles make up 29% of total commutes, by far the highest in the UK (Cervero, Denman, & Jin, 2019). However, this did not guarantee that a bike share would be successful. In 1993, Cambridge became one of the first places to launch a citywide bike share program. This program, called the Green Bike Scheme, was well ahead of its time, but failed when nearly all the bikes were stolen and/or vandalized within the first month of operation (Pilgrim, 2017). The story of this rather dramatic failure has haunted Cambridge’s new bike share program, launched in 2017 and run by a company called ofo. This dockless program allows users to request a bike for rental through an app. As with the Green Bike Scheme, many of the ofo bikes were dumped or vandalized. ofo implemented a points system to track how users cared for the bikes and ban users who lost too many points. Users were displeased, however, as this change was not made clear to them in advance (MacKenzie, 2018). Even with these changes, ofo could not overcome
the costs of operations, and ultimately cancelled its UK operations in January 2019 (McIntyre & Kollewe, 2019).

Despite such failures, other schemes have proven there is plenty of room for good bike shares in the UK. A prime example of a successful bike share is the Derby City Council. The Derby City Council launched its electric bike share program in July 2018, and it was immediately successful. The initial 50 e-bikes available were ridden a total of 7,200 miles during the first month alone (Shrubb, 2018). Users can dock the bikes at any of the docking stations located around the city, or they can choose to lock the bikes elsewhere for a small fee. To prevent misuse such as dumping, officials track all of the bikes by GPS. Members used the bikes not just for commuting but also for leisure, indicating that they are enjoyable to use recreationally as well as for transportation (Shrubb, 2018). Two hundred e-bikes are available to rent.

One final example of a bike share in the UK is London’s Santander Cycles. This bike share program started with 5,000 bicycles spread across 315 docking stations (Li, Ding, Ren, & Xu, 2018). Since its launch in July 2010, the program has more than doubled its size to over 11,500 bicycles and over 750 docking stations (“Santander Cycles”, n.d.). Some factors affecting bike usage, such as fluctuations in weather conditions, are easy to predict as reasons to deter bike users. However, the location of docking stations in relation to cycle paths, roadways, population density, and other factors also affects how often they are used. The Greater London Authority has been working on developing a network of “cycle superhighways”, which are dedicated bike paths/lanes running throughout the city (“Santander Cycles”, n.d.). One study done by Li et al. focused on the impact cycle superhighways have on the bike share usage, revealing a very strong positive correlation. The study found that docking stations within a 300-meter proximity to a cycle superhighway have on average 27% more users than those outside the range. Journeys that both start and end within this range show an increase in ridership of 73% (Li et al., 2018). Given the population of London and its efforts to allow bikers to navigate the city safely and easily, it is evident why this bike share has become successful. In the context of this project, the question that remains is how best to translate these efforts to a smaller city such as Worcester.
Overcoming Barriers to the Adoption of Bike Sharing

Examples of past and present bike shares have found that preventing theft and vandalism as well as providing adequate docking and tracking are necessary for a scheme to succeed. However, many other factors contribute towards deciding the fate of a bike share. These factors include bicycle infrastructure, public attitudes toward cycling, and population density. In this section, we will examine current barriers to the adoption of bike sharing programs as well as how to overcome them.

The Barriers

Fishman, Washington, and Haworth published a study in 2012 on the current opinions on bike sharing. The study, which involved discussion with focus groups, looked at Brisbane, Australia’s bike share scheme CityCycle and the city residents’ thoughts on why or why not they chose to use the program. In Figure 3, the numerical values represent the mean score for each barrier to using the scheme, with a score of 0 representing “not at all” and a score of 4 representing “a lot” (Fishman, 2015). The graph shows that convenience (prefer driving, helmet carrying, and proximity of docking stations to home and work) is a major factor, as is safety.

![Figure 3: Reasons cited for not participating in the CityCycle bike share (Fishman, 2015)](image-url)
All CityCycle focus groups expressed very similar opinions, commenting that a main concern was the user’s safety. With a lack of biking-related infrastructure, bikers need to share the roads with vehicles. Bikers were concerned by the driving habits of vehicles, specifically that drivers tended to either disregard the bicycles or simply not notice them. Others, particularly those who did not frequently use bikes, were discouraged by mandatory helmet usage. Some individuals said that bike-only lanes would improve safety and prevent the need for helmets. There appears to be a misconception that the majority of serious bike accidents involve motor vehicles, when in fact about half do not involve vehicles at all but involve fixed objects and pedestrians (Fishman et al., 2012).

A long sign-up process can also be a significant barrier to many potential users. Continuing with Fishman et al.’s study (2012), those interviewed mentioned that the inability to rent a bike on impulse prevented them from trying the system when it was being implemented. It is the general standard for bike shares to be accessible to anyone at any time, usually by simply swiping a credit card and taking a bike. Potential user interest is highest upon the launch of the program, so even if the sign-up process is simplified later, interest will have dropped. A lengthy registration process also inhibits visitors and tourists from signing up. The study quotes one member of Brisbane’s CityCycle who recently visited London and used London’s bike share: “…if I had to go through the same process as I had to through CityCycle, I would never have rented the bike” (Fishman, 2012).

Overcoming the Barriers

Some of the main motivators for using bike shares are direct opposites of the barriers. For example, commonly cited reasons for not using the Australian CityCycle scheme were that there were no docking stations near a respondent’s home nor work (Fishman, Washington, & Haworth, 2012). Conversely, a commonly cited explanation as to why users of CityCycle began participating in the scheme was that docking stations were in fact located near their places of work (Fishman, 2015). Figure 4 shows what motivated two different Australian bike share programs to become members of their respective schemes. The numerical values represent the
mean score for each motiva tor to using the scheme, with a score of 0 representing “not at all” and a score of 4 representing “a lot” (Fishman, 2015). This graph highlights that convenience in general and the proximity of docking stations to workplaces are major incentives for participation in bike share schemes.

Figure 4: Motivators for using the Melbourne Bike Share and CityCycle programs (Fishman, 2015)

Another way to increase the number of users of a bike share is to modernize existing and create new bicycle-related infrastructure. This proved to be a successful strategy for increasing bicycle riding in the Netherlands, where new and upgraded bicycle parking spots, coupled with the nation’s bicycle-friendly routes, helped bolster the adoption of cycling (Martens, 2007). Those routes are also critical in their own right. One study showed that the physical layout between destinations is an important factor in the regular use of bicycles (Handy, Xing, & Buehler, 2010). As mentioned previously in the section on UK bike shares, London has established a network of bike paths. Studies have indeed shown that such infrastructure increased how often the bike share was used (Li et al., 2018).

Another way to increase ridership in bike sharing programs is to strategically place docking stations in response to population density. As Vogel et al. (2014) point out, most
research suggests that users of a given station tend to live close to that station. O’Brien, Cheshire, and Batty (2014) approximated a buffer of one kilometer around each docking station to estimate which users each station is probable to attract. They picked this distance to balance between the desired walking and biking distances to the station (Vogel et al., 2014). Keeping this in mind, ridership could be increased in specific areas simply by adding a docking station within a reasonable distance of a dense population center.

Another method of increasing adoption of bike sharing is to utilize electric bicycles. The organization CoMo UK, formerly known as Carplus Bikeplus, and the UK Department of Transport reported that in the successful bike sharing programs they studied, “one in three riders rarely or never cycled before they started using shared e-bikes” (2016, p. 19). They propose this is likely due to the increased confidence electric bike riders experience as opposed to traditional bike riders. They state this may be because non-bikers feel more confident on electric bikes because the pedal assistance offered helps them navigate situations that are trickier for non-bikers, such as fatigue or hard terrain. In addition, Carplus Bikeplus and the UK Department of Transport (2016) note the accessibility that electric bicycles provide. Since electric bicycling is less strenuous than traditional bicycling, it is a good alternative for those with health issues.

The implementation of e-bikes into bike share programs also helps to alleviate the safety concerns that riders have. CoMo UK found that while people felt uncomfortable cycling amongst motor vehicle traffic, e-bikes made them feel safer and that they “could keep up with the pace of the traffic, which gave them confidence” (Carplus Bikeplus & Department of Transport., 2016, p. 20). This increased safety made riders more comfortable with taking longer and more numerous trips with e-bikes. The same study found distance of trips was also boosted by the e-bikes allowing for quicker and less physically taxing travel than pedal bicycles (Carplus Bikeplus & Department of Transport., 2016, p. 20). The user-specified benefits of e-bikes can be found below in Figure 5. Four of the top five benefits cited are directly linked to the physical assistance that e-bikes provide, which allows riders to travel faster but still with less effort than if they used a traditional pedal bicycle.
Worcester Bike Share

Among the bike shares operating in the UK is the Woo Bikes program at the University of Worcester in England. Understanding the university, its sustainability values and goals, and the Woo Bikes program itself are key to implementing successful ideas into our project. A comprehensive look at the school and its sustainability department can be found in the sponsor description in Appendix 1.

Woo Bikes built upon the university’s established bike share program, which already had 60 members and had been operating since 2012 (Gibbia, Lightbody, Terry, & Vollum, 2018). The initial fleet consisted of only pedal bikes; however, the Woo Bikes initiative saw the inclusion of e-bikes as well. There are now 100 bikes total, 50 pedal bikes and 50 e-bikes. Pedal bikes can be rented out for a week at a time, whereas e-bikes must be returned after 24 hours. Students and staff can sign up online for an annual fee of £45. This includes a free helmet, lock, and lights that can be picked up when a bike is checked out. A battery will also be provided for an e-bike. All of these things are returned along with the bike when the rental period is over unless the bike rental is renewed. Bikes can be stored at any appropriate bike rack either on or off campus (University of Worcester, n.d.).
Recently, the university has also begun to explore adding the Stack Rack Bicycles program to their bike sharing endeavors. This program aims to add space-saving bicycle racks to locations such as the local train station to encourage commuters to utilize bicycles on the last leg of their commute. This system would allow users to use a smartphone app to book a bike before beginning their commute, take out that bike at their destination train station, use the bike during the day, and return it to the rack at the train station during their commute home (C. Carey, personal communication, March 22, 2019). As bike-sharing programs in Worcester continue to grow, especially through the expansion of e-bike fleets, Woo Bikes will need to be aware of research and experience in bike sharing.

There are several employers in the Worcester area looking to implement their own bike pool system. These employers would each receive a set of the e-bikes from the Woo Bikes scheme for use by their employees. A major use case for these bikes would be for business trips across town. In addition, some employees may be able to commute using these bikes. Transport for London has identified barriers to getting employees to utilize the bikes, which include concerns over safety, or cycling ability, lack of interest in cycling and worries about getting sweaty while cycling. However, the latter of these can be alleviated by the pedal assist provided by e-bikes, and the two former concerns can be solved by holding different events. For cycling safety and ability, employee training sessions can be organized. Additionally, for lack of interest, trial sessions can be held where employees test out the e-bikes themselves (Transport for London, n.d.).
Methodology

Our goal was to identify ways to increase the adoption and use of bike sharing in the City of Worcester and at the University of Worcester. There are five objectives we completed to fulfill this goal:

**Objective 1:** Evaluated best practices in promoting and managing bike share schemes in the UK, specifically schemes with e-bikes

**Objective 2:** Assessed the barriers to and opportunities for the adoption of bike share schemes among selected large employers in Worcester

**Objective 3:** Assessed the attitudes of students at the University of Worcester toward cycling and bike share schemes, and especially the use of e-bikes

**Objective 4:** Gauged interest in and concerns about the adoption of Stack Rack Bicycles in Worcester

**Objective 5:** Conducted events to promote the adoption and use of bike sharing in Worcester

We used a mix of methods ranging from engaging with members of the Worcester community through interviews and surveys and learning about best practices through stakeholder interviews and unobtrusive research. Figure 6 includes each task and shows how they relate to the overall goal and objectives.
Figure 6: Project goal, objectives, and sub tasks
Objective 1: Evaluated best practices in promoting and managing bike share schemes, specifically schemes with e-bikes

We supplemented our background research on the barriers and motivators to bike share use with research on additional resources not available in the US. This included recent surveys conducted by the University of Worcester and interviews with representatives from bike share programs elsewhere in the UK.

We reviewed recent transportation surveys conducted by the University of Worcester, which provided data on how University of Worcester students and staff travel to and from campus, what factors affect their decisions, and their awareness of the Woo Bikes program. Based on these data, we were able to plan out our next steps for bringing more students into the program.

In order to obtain information on successful bike shares, we interviewed stakeholders in successful bike share programs, especially those that use e-bikes. We contacted thirteen such stakeholders and were able to set up five interviews. The interviews allowed us to get a better picture of how a successful bike share program functions and to develop insightful strategies to improve the promotion and working functionality of the Woo Bikes program. Among the people we interviewed are key individuals involved with the e-Bike Derby, Croydon Council, Plymouth Bike Hire, and Worcester City Council bike sharing programs, as well as the interim executive director at CoMo UK, an organization heavily involved in promoting bike sharing.

We conducted these interviews over the phone with at least two team members present, where one managed the questions and direction of the interview and at least one other took notes. The interviews lasted around 20 minutes. We developed a preamble and script (Appendix 2) in consultation with our advisor. We tailored the questions to the expertise of our interviewees and used them to guide the discussion during the interviews. The preamble described the nature of our research and explained that the interviewee may stop the interview at any time or skip any questions they prefer not to answer. We solicited the interviewee’s permission to quote them by
name and gave them the opportunity to review any materials from the interview that we use in our report prior to publication.

**Objective 2: Assessed the barriers to and opportunities for the adoption of bike schemes among selected large employers in Worcester**

Upon our arrival in the UK, the University of Worcester had been helping the local employers Worcestershire County Council, Worcester City Council, and Fortis Living start their own e-bike sharing programs. The university would help create interest in bike pools in the companies and provide e-bikes to the employers. In order to assess the barriers and best practices for setting up these bike pools, we interviewed contacts at each employer. These contacts were identified for us by our sponsor as the contact responsible for setting up the bike pool at each employer. We emailed most of these contacts asking them if they were available to talk to us about their experiences so far in setting up the bike pool. If the contact did not follow up in a timely fashion, we emailed again or contacted them by phone. We developed our interviews by consulting our advisor and sponsor to make sure our scripts were effective. When possible, we conducted the interviews in person for about half an hour. However, if the interviewee preferred, we conducted a phone interview instead. We completed the phone and in-person interviews in the same manner, using the same protocol outlined in Objective 1. These interviews were semi-structured, meaning we started with the developed interview questions and tailored them as we went through the interview. A sample preamble and script for the employer interviews can be found in Appendix 3.

In addition to completing interviews with contacts at pertinent employers, we also helped set up and run promotional “Have-a-Go” events with the employers to introduce the employees to the bikes. At each employer, we set up a time to bring Woo Bikes e-bikes as well as helmets and high visibility vests to their office location. After signing a university-provided indemnity form and receiving a short lesson on how to use the Woo Bike, employees were allowed to test the bikes by riding around for a few minutes. We produced a survey on the university’s Jisc Online Surveys software for the employees to take afterwards to judge their interest in the bikes.
The preamble for the survey and the survey questions can be found in Appendix 4. We ran Have-a-Go events at Fortis Living and Worcestershire County Council on April 10th and at Carefour on April 11th. We did not complete an interview at Carefour because they are not trying to set up a bike pool at their office. Instead, they are partnering with the University to provide free Woo Bikes memberships to student workers who work for their agency. Therefore, the purpose of the Have-a-Go was to introduce the employees of Carefour to the Woo Bikes program, not to try to increase interest in a bike pool being provided at Carefour.

Objective 3: Assessed the attitudes of students at the University of Worcester toward cycling and bike share schemes, and especially the use of e-bikes

The University of Worcester already had sufficient information on current Woo Bikes users from previous surveys; however, it was interested in knowing more about why students do not use the scheme. Therefore, we interviewed a sample of students that had never used Woo Bikes before. The interview script was refined by consulting our advisor and sponsor to ensure the interviews were as effective as possible. Appendix 5 contains a sample preamble and script for these interviews. We started by asking our University of Worcester flat mates if they had ever used Woo Bikes. If so, we politely terminated the interview. If not, we asked them a short series of travel-related questions.

These interviews were done in person and lasted about 5 minutes. The interview questions were focused on the student’s current commute, their thoughts on Woo Bikes, and if they would consider using such a bike share program. After the conclusion of the main portion of the interview, they were offered a chance to test out an e-bike from the Woo Bikes program. If they accepted, they were allowed to ride the e-bike around for a few minutes on the paved areas around the flats. Afterwards, we asked them to answer a few follow-up questions about their thoughts on the e-bike (also found in Appendix 5). If they chose not to try the bike, we asked a different set of follow-up questions on why they chose not to and how we may convince them to
try it in the future (again see Appendix 5). The interviews were fairly structured but allowed for additional questions that may arise. The data acquired from these interviews was kept anonymous.

Objective 4: Gauged interest in and concerns about the adoption of Stack Rack Bicycles in Worcester

Another area in which we completed tasks was performing research regarding the implementation of the Stack Rack Bicycles system in Worcester. When we began our work in Worcester, the West Midlands Trains company and Stack Rack Bicycles were in negotiations to install the innovative Stack Rack Bicycles bike rack system at train stations and university locations in Worcester. The intent is that students and staff at the university would be able to use Stack Rack Bicycles for last mile travel, with a pilot program being launched in June. The University of Worcester, Stack Rack Bicycles, and West Midlands Trains wanted more information on attitudes and opinions of potential users towards utilizing such a bike share scheme.

Interviewing Stakeholders

Before collecting the data, we interviewed two stakeholders in the Stack Rack Bicycles operation: Dr. Charles Carey of Stack Rack Bicycles and Jon Harris, a representative of West Midlands Trains. The former is the creator of the Stack Rack Bicycles technology and scheme while the latter’s company is subsidizing and promoting the scheme in Worcester. We gathered relevant information from these two sources, including a comprehensive description of Stack Rack Bicycles, any obstacles that had been encountered, and each contact’s respective reasons for wanting to implement the program. Lastly, we utilized each of their responses to develop a plan for the types of data for us to gather, as well as added the development of a Stack Rack Bicycles promotional plan into our scope.
These interviews followed the protocols described above using the scripts found in Appendix 6. We interviewed Dr. Carey in person and Jon Harris over the phone. Both were relatively unstructured, and we only specifically asked a few key questions of each interviewee. We gathered the majority of information from open-ended questions.

Gathering Data

In order to obtain the data that the Stack Rack Bicycles stakeholders wanted, we developed a survey that was applicable to both staff and students, found in Appendix 7. The survey asked participants about their travel habits, their level of interest in the program, and the reasons for their interest or lack thereof. We developed the survey instrument based on prior university survey questions regarding travel, with input from our advisor, our sponsor, Dr. Charles Carey and Jon Harris.

For staff, the university distributed the survey in the weekly newsletter. We created the survey itself on the university’s Jisc Online Surveys software. Every staff member received an email with a link to a blog post that contained a description of the Stack Rack Bicycles service, a link to the survey, instructions for those who wanted further details about taking part in the Stack Rack Bicycles pilot program, and details for entering a raffle. We used this raffle entry as an incentive for staff to complete the survey and contained such prizes as a handheld vacuum cleaner. Twenty-three staff members participated in the survey.

We gathered student data by splitting into groups of two team members and conducting intercept surveys in populated areas on both St. John’s and City campuses, including both campuses’ main reception buildings as well as the Student Union building. We handed participants a tablet with the online survey pre-loaded on the screen. For larger groups, we read the preamble aloud and recorded the responses for the full group on paper. We later entered these responses into the survey software and confidentially disposed of the original papers. We used the incentive of receiving a piece of candy upon survey completion to incentivize students to participate. In total, 103 students took the survey.
Objective 5: Conducted events to promote the adoption and use of bike sharing in Worcester

We ran a series of promotional events for Woo Bikes at different locations and venues on the University of Worcester campuses. As we ran these Have-a-Go sessions, we experimented with different locations and times on campus in order to find the most conducive conditions to getting staff and students on the bikes. We also took suggestions about where and when we could set up to better our chances of a successful session.

In order to promote awareness as well as give students and staff the opportunity to try out the system, we set up these Have-a-Go sessions in locations where anyone could test out e-bikes in a controlled environment. We utilized paved paths around campus as a clean, safe environment for bicycle testing. This was intended to encourage those that might be tentative about riding on public roads to try out the bikes. Before the students and staff set off on their test runs, we ensured that they were aware of how to operate the bikes safely, were dressed appropriately (e.g., sensible shoes), were wearing a helmet, and filled out the required indemnity form. When they returned, we handed them a tablet containing a very short preamble explaining the nature of the research and asked them to fill out a short exit survey about their experiences. The survey was built on the Jisc Online Surveys software and took only a minute or two to complete. The questions were limited as much as possible to make the survey short and manageable while still allowing the students to give us the information we need. An example of this survey can be found in Appendix 8.

We also created a second survey using the same software for people that chose not to ride on our bikes. We conducted this survey in the same manner as the survey for those who rode on the bikes. An example of this survey is located in Appendix 9. We worked with our sponsor and advisor to revise these surveys and appropriate protocols before we deployed them at the promotional events.
In addition to on-campus student events, we also held a session during Go Green Week, a citywide event focused on sustainable practices. This particular session targeted local employees with the goal of influencing those who tried the bikes to report to their managers that they would like to set up a company bike share. The procedure for the session was identical to that used for the on-campus promotional events.

To supplement the promotional events, we also made promotional materials such as leaflets and a poster. The leaflets described future dates of the Have-a-Go sessions. We distributed them by placing them around the Student Union building, handing them out to Stack Rack Bicycles survey participants, and giving them to our flat mates to spread to their peers. The poster was a large simple poster that we displayed at the promotional events to attract nearby students and staff to try out our e-bikes.
Findings

After completing numerous surveys, interviews, and events, we have collected enough data to be able to understand the status of bike sharing in Worcester, England. Our findings are presented below, starting with information obtained from stakeholders in nearby bike shares, followed by our results regarding Woo Bikes both on and off campus, and concluding with our discoveries related to Stack Rack Bicycles.

Stakeholder Opinions on the Barriers and Opportunities for Bike Share Programs

The Woo Bikes scheme is different from traditional bike share programs in the sense that the bike rental periods for Woo Bikes are much longer (24 hours for an e-bike and 7 days for a pedal bike, whereas traditional scheme rentals typically last just a few hours). Despite this discrepancy, stakeholders involved in other more traditional bike shares were still able to provide useful advice about the barriers to bike sharing and how to overcome them. Much of this information reinforces the findings from previous research described in the background section above.

One of the main barriers we found from our interviews with individuals involved in bike shares in the UK was providing infrastructure that allows users to feel safe. This was cited by Dr. Charles Carey of Stack Rack Bicycles as being the single most important hurdle to overcome in terms of getting people to cycle, and that an “environment conducive to cycling” is the best way to increase the use of bikes (C. Carey, personal communication, March 22, 2019). Tim Caswell of e-Bikes Derby also noted infrastructure to make routes feel safe as a prominent barrier (T. Caswell, personal communication, March 25, 2019). He mentioned that making maps of clearly defined bike routes widely available is important to show potential users that there are safe ways to cycle to their destinations.
We also discovered that overall convenience and ease of use were critical in motivating people to adopt bike sharing. Tim Caswell stated that convenience is the most important thing to keep in mind in all facets of a bike share. This includes having a quick and simple sign-up process followed by an easy, straightforward method of getting to the bikes themselves. These can be achieved by automating the registration and check-out process and minimizing the number of different virtual and real locations a user must visit before getting on a bike. Caswell additionally noted to us that having multiple pick-up locations is helpful in making a program more seamless to use (T. Caswell, personal communication, March 25, 2019).

In the same vein, our communication with Peter McDonald of Croydon Council revealed that complicated processes can be a deterrent to using a bike share. He stated that he thinks the low usage of Croydon Council’s employee bike program is due in large part to the complicated procedure to get an employee from initial interest to actual use. In Croydon, this procedure includes first undergoing training to ensure cycling competency, followed by booking a bike online or going to a concierge in the office building, then heading to the basement of the building to get to the bikes. The basement location also raises multiple issues. The footpath involves getting the relatively heavy bikes up over a high curb and following a narrow footway to get to a narrow gateway, where there are large heavy gates to get through. For these reasons, those who do utilize the bikes tend to use the main vehicle entrance instead, deterring people who do not feel comfortable on main vehicle roadways from using the bikes at all (P. McDonald, personal communication, March 27, 2019). It is these kinds of issues that any employer needs to think through before setting up an employee bike pool program, so that anything that can get streamlined without sacrificing safety is streamlined.

We also received advice on setting up successful employer bike schemes from our interviews. One of the most important decisions that needs to be made before implementing a bike share for employees is the plan for maintenance and management of the bikes. Mark Radford informed us that the responsibility for managing the rentals for the bike share at Worcester City Council was assigned to the custodian service and maintenance was handled by the company Spokes. Since these assignments were made very clear initially, the bike program at
the Council has gone smoothly and usage is expected to pick up over the summer months (M. Radford, personal communication, April 5, 2019). We discovered that such a designation had not been made clear at Croydon Council, and thus Peter McDonald had to assume responsibility for their scheme. Since the bikes were not his primary job, he could not commit a substantial amount of time and effort into managing the bikes on top of his other duties, and the bike share has seen low usage (P. McDonald, personal communication, March 27, 2019).

Our interviews also identified insurance as a major hurdle to overcome in establishing an employer bike share. Employers must ascertain that they have insurance policies and procedures in place to cover staff using the bikes should any type of incident occur, since safety is a major concern in bike sharing. Antonia Roberts of CoMo UK (A. Roberts, personal communication, April 4, 2019) and Mark Radford (M. Radford, personal communication, April 5, 2019) both cited this as a necessary roadblock faced by employer bike programs. Peter McDonald noted that determining how to handle insurance was a cause for delay in launching the Croydon Council bike program also (P. McDonald, personal communication, March 27, 2019).

Finally, we gained insight into effective methods of bike share promotion from our interviews. We found that the most important method for promoting a bike share is making sure the bikes are physically seen, out and about and being used, by potential users. Antonia Roberts cited this as a crucial aspect of promotion and noted that having attractive bikes would help even further (A. Roberts, personal communication, April 4, 2019). Tim Caswell also supported this statement, saying that the most important matter in promoting a bike share is having bikes that people want to use. He stated that e-Bikes Derby hired University of Derby students to promote the scheme primarily by using the bikes around campus (T. Caswell, personal communication, March 25, 2019). Additionally, Mark Radford stated that the main method of promotion for the bike program at Worcester City Council is letting staff see the bikes being used for themselves, in hopes that a greater number of people knowing about the scheme will lead to increased usage.

If a bike share has e-bikes (like Woo Bikes does), those can be specifically promoted in order to entice users into trying the scheme. We learned from Tim Caswell that the e-bikes in the
e-Bikes Derby program are used to build a branding of “Fast, Affordable, Fun”. This simple slogan provides an apt description of riding e-bikes to potential users without being overly verbose (T. Caswell, personal communication, March 25, 2019). Andrew Thompson of Plymouth Bike Hire reiterated the assertion that e-bikes can help with the promotion of a bike share, stating that there is a so-called “e-bike smile” that people have when they first try e-bikes. This positive image can also be used in establishing a branding for a scheme (A. Thompson, personal communication, April 5, 2019).

Other useful methods of promotion we discovered include signage and online presence. Antonia Roberts stated that having physical materials discussing what the bike share is about and how to join will lead to a positive image in the area (A. Roberts, personal communication, April 4, 2019). Tim Caswell also mentioned that signage and other physical advertisements are used to promote e-Bikes Derby, specifically mentioning leaflets that get handed out to University of Derby students in a student pack as well as utilizing the TV screens around the campus (T. Caswell, personal communication, March 25, 2019). He also stated that social media can be used as a method of promotion. e-Bikes Derby specifically uses representatives from student groups to help manage the social media presence of the scheme. Andrew Thompson also cited social media as an important promotional strategy, citing that his program’s primary publicity comes from their social media channels and website (A. Thompson, personal communication, April 5, 2019).

Perceptions and Promotion of Woo Bikes

Our involvement with the Woo Bikes program included promotion both on and off the University of Worcester campus. On campus, our efforts were directed towards increasing the use of the existing program by staff and students by focusing on understanding perceptions of the program. We also took the e-bikes off campus, demonstrating them to local employers interested in establishing their own bike share systems using e-bikes from the Woo Bikes scheme.
On Campus Perceptions and Promotions

To help determine how to best promote bike sharing at the University of Worcester, we examined survey results from the staff and student travel surveys administered for the past two years by our sponsor, the university’s Department of Sustainability. Each survey was administered at the end of the calendar year to determine overall travel habits among students and staff. The results were helpful in determining the likelihood that bike sharing programs at the university would be utilized.

We mapped student (Figure 7) and staff (Figure 8) home locations for 2018 using postcode data from the travel survey. The maps show a concentration of staff and students near the university campuses who might amenable to biking, as well as many further away who might be candidates for Stack Rack Bicycles.

Figure 7: Map of student home postcodes, 2018
Carplus Bikeplus and the Department of Transport (2016) published a report on shared electric bikes stating that the average journey on a traditional pedal bike is three miles, while on an electric bike, this distance is extended to five miles. Both of these radii are important in determining probable bike share users at the university since both pedal and electric bikes are available through the Woo Bikes scheme. The travel surveys reveal that 61% of students lived within five miles of campus in 2017 compared with 53% in 2018 (Figure 9), and difference likely reflects the change in composition of the student body. By contrast, the proportion of staff living within five miles is quite similar in 2017 (43%) compared with 2018 (41%), which reflects the greater stability of the staff population.
While we determined that there is a large number of students on campus that could benefit from the Woo Bikes program, student usage of Woo Bikes could still be encouraged further. In order to investigate why the program is not being used by students who could benefit from its use, we conducted interviews of seven students on St. John’s campus, none of whom had used Woo Bikes before. Four of these interviewees mentioned that Worcester is not a particularly ideal city for cycling and suggested clarifying specific bike routes and dedicated areas to cycle. The results of the 2018 student travel survey highlight this assertion since approximately 33% of respondents said the City of Worcester is not conducive to cycling. Three interviewees stated that they would consider using the Woo Bikes program if the bikes themselves were in locations that were more convenient to access. Upon being asked if they would like to try out an e-bike, five of the interviewees declined, with the most common reasoning being that the interviewee either did not know how to cycle or had not cycled in years (this response was given by three of the five who declined).

We had similar trouble getting members of the campus to try the bikes at on-campus Have-a-Go sessions. After running ten Have-a-Go sessions on campus, we were only able to get three people to test out the e-bikes in total. Although the three people who did test the e-bikes
provided very positive feedback, the lack of data points makes it difficult to draw any firm conclusions. We also obtained three non-rider survey responses from people who stopped but chose not to try a bike. All three non-riders stated in their responses that they would be more likely to try the bike if we held the Have-a-Go session in a more convenient place or time, such as outside the Drama Studio or after lectures. Other suggestions included holding the sessions in consort with other campus events and providing advance notice on when the sessions would be held. We took the advice to give advance notice and created leaflets advertising when and where Have-a-Go sessions would be held the following week. The design of the leaflets can be found below in Figure 10. These flyers were distributed around campus, mostly in common areas such as the Student Union. We also distributed them to people who offered to take our Stack Rack Bicycles student survey. However, these flyers did not attract any students to attend any of the Have-a-Go sessions.

![Flyer used to advertise Have-a-Go sessions](image)

Figure 10: Flyer used to advertise Have-a-Go sessions
We began by running Have-a-Go sessions with the university’s Woo Bikes gazebo (see Figure 11 below). However, after running two unsuccessful sessions, we decided against using the gazebo in the future as it was too time-consuming to set up and take down for ‘guerilla’ pop-up sessions, especially given the vicissitudes of the weather. During our second session using the gazebo, we saw many people walking past while we set up, but foot traffic had stopped by the time we were ready. For future Have-a-Go sessions, we printed out a large sign to use as an attention grabber. The sign, which we printed on A2 paper (approx. 42 x 59.4 cm), appeared to work better at attracting attention even if not everyone who saw the sign stopped to talk or try a bike. Additionally, it gave us more freedom to relocate when necessary. The sign is shown in Figure 12 below.

![Figure 11: The Woo Bikes gazebo used in some Have-a-Go sessions](image-url)
We still think that running the Have-a-Go sessions was helpful for our research, however; because we had the sessions at different times of day and in different locations, we were able to learn the best conditions under which to hold a session. We discovered that even the slightest bit of warning of bad weather discourages people from getting on the bikes. On at least two occasions, we had to stop the session due to a storm, but even if the sky was just cloudy, people were less likely to engage with us. In addition, we found that people were more likely to engage with us when we were in a location where students would be on break time, such as around the Student Union building or near the café. Students would be more likely to stop and engage, even if they chose not to try a bike, if they were not occupied with other tasks.

Off Campus Perceptions and Promotions

From our interviews with stakeholders currently in the process of setting up employer bike shares, we discovered additional factors that can hinder or aid the implementation of the schemes. Henry Harbord of Worcestershire County Council identified the fact that establishing a
bike share is generally not part of regular business can be a hurdle to overcome. Additionally, the lack of an outright need for the staff to have bikes means there is no compelling reason to make launching a bike share a priority (H. Harbord, personal communication, March 26, 2019). Our interview with Tom Piotrowski of Fortis Living revealed that the setup process could be greatly helped by having a set of materials prepared when approaching an employer to discuss establishing a bike scheme. These materials could include a pamphlet containing a summary of the role Woo Bikes would play in creating the scheme as well as a manual containing general tips and procedures to follow for setting up the bike share. (T. Piotrowski, personal communication, April 5, 2019).

The Have-a-Go sessions that we ran at various employers were consistently successful with overwhelmingly positive feedback. During the session run at Worcestershire County Council on April 10th, seven employees tested out the e-bikes and a marketing team member took videos for marketing the scheme within the council. All employees who participated filled out the follow-up survey. At Fortis on April 10th, ten employees tested bikes and nine completed the follow-up survey. The Carefour session was intended to introduce current employees to the bikes to gain a familiarity with the concept throughout the company. Carefour and the University are currently discussing an agreement that would allow employees of the company who study at the University to obtain a free Woo Bikes membership. Our session on April 11th encouraged four employees to try the e-bikes and three completed the survey.

Between these three Have-a-Go sessions, we collected a total of nineteen survey responses. Of the nineteen respondents, seventeen reported that the bike was easy to use and took less effort than a traditional pedal bike. Additionally, twelve respondents said they felt safe using the e-bike. In contrast, the main complaint among six of the nineteen riders was that they felt less in control than with a traditional pedal bike. Other minor complaints were that the bike was faster than the rider was comfortable with and that the user had to put in more effort to control the pedal assist. However, the overall opinions on the bikes were still very positive. Sixteen of the nineteen respondents said they would be interested in using e-bikes for business trips, leaving only one person who would not be interested and two that were undecided. Responses were more
mixed for interest in using the e-bikes to commute: nine were interested, five were not, and five were neutral.

In addition to the Have-a-Go sessions conducted at employers, we hosted a Have-a-Go session in the city as part of the university-run Go Green Week. During this session, a total of nine people tried out the e-bikes and all responded to the survey. The feedback was generally very similar to the survey responses from the employer Have-a-Go sessions. Eight of the nine respondents said the bike was easy to use, with six saying they found it easy to get the bike up to speed. Again, the main dislike among the minority was the feeling of having less control over the e-bike compared to a pedal bike. We received mixed responses regarding whether or not respondents were interested in using the bikes for the purposes of commuting and making business trips.

University Staff and Student Opinions about Stack Rack Bicycles

We gained a more complete understanding of the Stack Rack Bicycles initiative through our interviews with Dr. Charles Carey and Jon Harris. We learned from Dr. Carey that one of the major selling points of Stack Rack Bicycles from a business perspective is the significantly lower operational costs, coming from the fact that it is not necessary to have operators of the system redistribute the bikes, as is the case with most docked and dockless traditional bike shares. Instead, there is a set location for users to which they return the bikes (C. Carey, personal communication, March 22, 2019). From Jon Harris, we learned that the driving factor for West Midlands Trains to implement Stack Rack Bicycles is the company’s policy of helping provide last mile travel for users of their trains. The company determined Stack Rack Bicycles’ design to be the one of the more innovative approaches and also used a small amount of space efficiently (J. Harris, personal communication, April 4, 2019).

Our surveys regarding Stack Rack Bicycles were quite successful: we were able to obtain over 100 student responses and over 20 staff responses. Respondents skewed female, with 74% of staff respondents and 67% of students reporting that they typically identify as female.
Seventy-three percent of the staff and 34% of students expressed either likelihood or high likelihood of using Stack Rack Bicycles. This disparity may be explained in two ways. First, the staff sample may be biased towards those interested in Stack Rack Bicycles since they were emailed the survey link and had to actively respond. Second, as shown in Figure 13, the majority (57%) of students live less than 5 miles from campus and are unlikely to commute by train on a regular basis. As shown in Figure 14, this is not an issue for the staff respondents since 73% of those respondents live over 5 miles from campus.

![Figure 13: Distance from campus reported by student Stack Rack Bicycles survey respondents](image1)

![Figure 14: Distance from campus reported by staff Stack Rack Bicycles survey respondents](image2)

We were also interested in knowing if the Stack Rack Bicycles system could convince people who drove to take the train and bike instead, since these are more sustainable modes of travel. For staff, ten out of the twelve respondents who stated they were currently commuting by car said a scheme like this would get them out of their car and using the scheme. Fifteen out of forty-two student respondents who currently drive said they would use the scheme instead of driving. The most often cited reason not to choose Stack Rack Bicycles over driving was that there is not a station close enough to the respondent’s home for them to utilize.

Finally, we assessed opinions about the preferred locations for possible Stack Rack Bicycles facilities. The University of Worcester consists of four campuses, of which three are
most commonly used academically: St. John’s Campus, City Campus, and Riverside Campus. In terms of university locations, 78% of staff respondents and 90% of student respondents said they spent the most time on St. John’s campus. Most other respondents said they spend the most time on City Campus, with only one respondent across both surveys stating they worked most often on Riverside Campus. We also asked survey respondents to categorize their use of the Worcester Foregate and Worcester Shrub Hill train stations. Foregate appeared to be the more popular station of the two, with 77% of staff respondents and 26% of student respondents (who are proportionately far less likely to use the train overall than staff respondents) stating that they use Foregate Station at least occasionally. By contrast, only 28% of staff respondents and 6% of student respondents state they use Shrub Hill Station at least occasionally. The travel surveys for 2018 corroborate this for a larger sample size of staff and students within the University of Worcester population. In this survey, 24% of staff and 50% of students said they would occasionally use a service such as Stack Rack Bicycles at Foregate, while only 17% of staff and 37% of students said they would occasionally use the service at Shrub Hill.

As an addendum to the survey to maintain anonymity, eight staff members said they were interested in signing up for the Stack Rack Bicycles pilot program. We sent each of these people a message letting them know that they will be sent more information in the future when the details of the pilot program are fleshed out by the university staff, Stack Rack Bicycles staff, and West Midlands Trains.
Conclusions and Recommendations

Many people tried the e-bikes, both on and off the university campus, and were very complimentary of them. However, it was difficult to get students and staff to get on the bikes in the first place. For this reason, we have a few changes we recommend that the Sustainability Department makes to the promotion of the Woo Bikes program. These changes would help reshape Have-a-Go sessions in order to hopefully get more participants to experience e-bikes for themselves. Word-of-mouth from those trying out the bikes could help promote the program, as could the fact that more staff and students would see others trying out the bikes and enjoying them, and seeing the bikes is the single most important way to promote a bike share (A. Roberts, personal communication, April 4, 2019). On top of the Have-a-Go sessions, our changes would alter the current promotional plan in terms of the image of Woo Bikes, focusing on the “e-bike smile” effect that takes place when people try out an e-bike for the first time.

Because Have-a-Go sessions on campus drew the majority of participants when held alongside another event and were successful at employers and Go Green Week, we recommend that the Sustainability Department Woo Bikes staff always run Have-a-Go sessions in conjunction with other campus events. These could include sporting events as well as student-run pop-up events. Have-a-Go sessions are likely not successful on their own because students are often too busy to want to stop and try a bike on their way to somewhere else. Additionally, given that distributing leaflets with dates and times did not attract students to the sessions, we can infer that students are not interested enough to go out of their way to attend such an event. Therefore, if the Have-a-Go session is run alongside another larger event, it is much easier for students to spontaneously decide to try the bikes.

It should also be noted that for the same reasons, the Sustainability Department should use Have-a-Go sessions as a supplementary promotional method along with other primary efforts. We concluded based on the student travel survey and student interviews that a large percentage of students are not aware of the Woo Bikes program. Therefore, we recommend having more signage advertising the scheme around campus. The electronic advertisement
boards in locations such as the Student Union building would be ideal for this, as students will be used to seeing advertisements for student events and programs on these. This advertisement method was used at the University of Derby to promote the e-Bikes Derby scheme, which has been very successful (T. Caswell, personal communication, March 25, 2019).

Based on our background research as well as some of our employer interviews, we concluded that one of the reasons that employers are not adopting bike pool schemes is because they are unsure about the details of what a bike pool would bring to their company and what kind of work they need to put in to maintain the program. Therefore, we recommend that the Sustainability Department develop a standard media package and manual to give to employers looking to set up their own bike pool programs. We found from our interview with Tom Piotrowski that official documentation to hand to supervisors would make it easier to convince those supervisors to seriously consider adopting a bike share (T. Piotrowski, personal communication, April 5, 2019). The media package would outline the overall process of setting up a bike pool through Woo Bikes in a clear fashion in order to minimize confusion that might otherwise arise from back-and-forth communication between the Woo Bikes team and various employers. The manual would be more detailed, describing hurdles that may be encountered such as insurance and maintenance responsibility assignments. It could also provide suggestions for locations to place the bikes and the method by which the bikes could be booked. Sample material for the media package can be found in Appendix 10 and an example manual outline can be found in Appendix 11.

In terms of Stack Rack Bicycles, we recommend to West Midlands Trains, Stack Rack Bicycles, and the Sustainability Department to put racks at both Foregate Station and St. John’s campus based on an overwhelming majority of survey responses indicating these as the primary locations used by both staff and students. This will allow staff and students who are members of Stack Rack Bicycles to travel between Foregate Station and campus for the purposes of commuting and have a place on campus to put the bikes for the time until they need to go back to the station. Additionally, no racks should be put at Worcester Shrub Hill Station. We concluded that since our survey results showed a very clear lack of people who commute to the university
campus via Shrub Hill, with only a few people even saying that they at least do so less than once a month, there was no demand for Stack Rack Bicycles at Shrub Hill. The racks would be much more effective at Foregate Station.

As with Woo Bikes, we recommend the Sustainability Department and West Midlands Trains increase the amount of promotional materials on campus advertising Stack Rack Bicycles as a service. Campus wide emails, posted flyers, and video advertisements that play on campus displays are all ways we recommend advertising the services. We have included an example flyer for this in Appendix 12. We recommend that the advertisements should focus on each target group separately, since the surveys indicate a very different level of interest between students and staff members. As found in the surveys, many more students are likely to live on or close to campus, and therefore the advertisements should focus on occasional travel. Staff members are much more likely to live farther away from campus and commute via train, and so the advertisements should focus on daily travel.

Finally, we recommend that future researchers continue to follow the Stack Rack Bicycles pilot program throughout its implementation. Additional research should also be conducted on the University of Worcester campus regarding student opinions on Woo Bikes, possibly through intercept surveys and handing the participants promotional materials. Lastly, future researchers can fully develop the media package and setup manual for employers looking to establish a bike pool program.
References


https://tfl.gov.uk/modes/cycling/santander-cycles


Sisson, P. (2018, June 28). Why electric bikes can provide a big jolt to bikeshare systems. Curbed.


University of Worcester. (n.d.). Retrieved March 26, 2019, from https://www.worcester.ac.uk/


Appendix 1: Sponsor Description

The University of Worcester is an educational institution located in Worcester, England. Founded in 1946, the school is attended by about 10,000 students. Each of these students becomes immersed in an environment dedicated to sustainable practices and ideals, as the university is one of the greenest in the UK. The university ranked 4th in a list of “UK universities ranked by environmental and ethical performance” (How Sustainable is Your University?, n.d.).

The sustainability department of the university “works to increase the awareness of sustainability and social responsibility with students, staff and members of [their] communities and contributes to sustainable development in all areas of the University” (University of Worcester, n.d.). They also engage in furthering sustainability efforts with others. The department accomplishes this task by “develop[ing] local, regional, national and international networks to further the sustainability agenda” (University of Worcester, n.d.). A committee called Sustainability Strategy Group was created in 2005 in order to get staff and student involvement in creating strategies and methods that can help the department complete these goals. The group itself consists of 22 members (“Terms of Reference”, n.d.). In addition, there are 5 full-time employees and 16 student part-time posts working in the department (University of Worcester, n.d.). The institution takes great pride in their sustainability metrics, reporting its annual progress on the UN Sustainable Development Goals. These reports allow for direct benchmarking against similar institutions (University of Worcester, n.d.).

Students and staff at the University of Worcester are immersed in sustainability practices from the second they enter campus. For example, “all new staff have a mandatory induction into sustainability” (University of Worcester, n.d.). Similarly, the residential life team introduces sustainability activities to all residential students to inform them on how to live and study sustainably. Both staff and students are encouraged to live by the school’s ten golden rules for sustainable living at the university. The golden rules are reminders of ways to make everyday tasks more environmentally friendly. For example, rule number one is “Drink tap water, or use a
water fountain on campus” (“10 Golden Rules”, n.d.). Another rule encourages using video conferencing as opposed to physically traveling to attend in-person meetings (“10 Golden Rules”, n.d.). Both of these strategies are perfectly in line with the university’s vision and goals for sustainability on the campus.

The University of Worcester has a number of programs related to their sustainability commitment. For example, there is an annual program for university residence halls called Student Switch Off. This program incentivizes students to reduce their energy consumption by offering prizes and an end-of-year pizza party. Students compete to minimize energy consumption in their residence halls and are able to see a live ranking on the university website. In the 2017-2018 academic year, the program reduced consumption by 52,091 kWh and saved an estimated 20 tonnes of CO₂ (University of Worcester, n.d.). Additionally, the university hosts student researchers focusing on energy management to determine the efficiency and consumption of campus buildings. These students work with the Energize Worcester energy management program to provide more opportunities for energy management through in-depth research on current opinions and feasibility. (University of Worcester, n.d.). The programs for the university expand across several different categories, including energy, waste management, and transport and travel.

One of the transport and travel projects that the sustainability department has implemented is the Woo Bikes bike share program. The program aims to get more students, employees, and citizens of the area to use bicycles instead of cars. Woo Bikes built upon the university’s established bike share program, which already had 60 members and had been operating since 2012 (Gibbia, Lightbody, Terry, & Vollum, 2018). The initial fleet consisted of only pedal bikes; however, the Woo Bikes initiative saw the inclusion of electric e-bikes as well. Recently, the university has also begun to explore adding the Stack Rack Bicycles program to their bike sharing endeavors. This program aims to add space-saving bicycle racks to locations such as the local train stations to encourage commuters to utilize bicycles on the last leg of their commute.
A major purpose of both bike sharing programs is the reduction of pollution on the university campus as well as within the city of Worcester. The more people that substitute their commutes in cars with bike journeys, the less contribution they make to air pollution and the use of fossil fuels. The hope of the sustainability department is that through the combined efforts of Woo Bikes and other transportation efforts on campus, the university can create “25% reduction [in] absolute tCO2e emissions from staff and students’ commuting to University on a daily basis by 2020 from a baseline 2010/11 of 6,843 tCO2e” (University of Worcester, n.d.). The real-life trend in these emissions from all sources can be found below in Figure 1. The red bar represents the goal set by the university for tonnes of direct carbon emissions per year. The blue bar represents the actual emissions, which are shown to be in decline since the 2013/2014 academic year.

![Year on year comparison of scope 1 & 2 tCO2e actual emissions against target](chart)

**Figure 1:** Carbon footprint of direct carbon emissions per year (Katy Boom, Director of Sustainability, personal communication, April 23, 2019)

Health and well-being of students and staff of the university is another primary focus of the sustainability commitment. The university was recently accredited by Worcestershire Works
Well, a scheme that aims to encourage businesses to implement good health cultures and recognizes the ones that do (Worcestershire Works Well, n.d.). The Woo Bikes bike share, in addition to providing a more sustainable mode of transportation, also falls in line with the goal of improved health and well-being at the university. Riding bikes between locations provides exercise, especially compared with the sedentary act of sitting in a car driving between places. The health benefits of this increase in exercise was explored by Celis-Morales et.al. in their study on active commuting. They found that “Commuting by walking was associated with a lower risk of CVD incidence and mortality. However, commuting by cycling was associated with the lowest risk of these as well as lower risks of all cause mortality and cancer, with dose dependent relations for all outcomes” (Celis-Morales et.al., 2017).

The University of Worcester has a strong commitment to their sustainability goals and practices. For over a decade, the school has been striving to meet and better accomplish the objectives they have set forth for themselves, including reduced pollution and greater health and well-being for its students and employees. The Woo Bikes bike share program is one initiative amongst the many of the university that meets these specific goals. It is an excellent addition to the university’s repertoire as it incites members of the community to exercise as opposed to sitting still in polluting cars.
Bibliography

https://www.worcester.ac.uk/documents/golden_rules_sustainability.pdf

About the scheme. (n.d.). Retrieved January 22, 2019, from
http://www.worcestershire.gov.uk/worcestershireworkswell/info/4/about_the_scheme


How Sustainable is Your University? (n.d.). Retrieved January 15, 2019, from
https://peopleandplanet.org/university-league

Terms of Reference (n.d.). Retrieved January 22, 2019, from


Worcestershire Works Well. (n.d.). About the scheme Information - Worcestershire Works Well. Retrieved from
http://www.worcestershire.gov.uk/worcestershireworkswell/info/4/about_the_scheme
Appendix 2: Bike Share Program Interview Script

Preamble

We are students from Worcester Polytechnic Institute in the United States. We are conducting research on bike sharing in collaboration with the Sustainability Department at the University of Worcester. We appreciate you taking the time to share your opinions. Your participation in this interview is completely voluntary and you may end the interview at any time or skip any questions you wish not to answer. Should we use any information from this interview in our final report, we will give you an opportunity to review the materials prior to publication. Can we quote you by name, or would you prefer to remain anonymous? The interview will take less than 15 minutes.

Interview Questions

1. Why did you choose to set up your bike sharing program?
2. How much has the bike sharing system been utilized?
   a. Why do you think it has been used this much?
3. (Question depends on whether or not this bike sharing program uses e-bikes) How has the presence/non-presence of e-bikes affected the satisfaction of the users of the program?
4. What goals do you have for the bike sharing program?
5. How do you promote the bike sharing program?
6. What negative feedback have you gotten from your users about the bike sharing, if any?
7. What positive feedback have you gotten from your users about the bike sharing, if any?
8. What do you think motivates or could motivate people to utilize the bike sharing?
   a. Have you seen any barriers toward getting people to utilize the bike sharing? How could these barriers be overcome?
Appendix 3: Employer Interview Script

Preamble

We are students from Worcester Polytechnic Institute in the United States. We are conducting research on bike sharing in collaboration with the Sustainability Department at the University of Worcester. We appreciate you taking the time to share your thoughts. Your participation in this interview is completely voluntary and you may end the interview at any time or skip any questions you wish not to answer. Should we use any information from this interview in our final report, we will give you an opportunity to review the materials prior to publication. Can we quote you by name, or would you prefer to remain anonymous? The interview will take less than 15 minutes.

Interview Questions

1. Why did you choose to set up a bike sharing program?
2. When did you first initiate obtaining the bicycles?
3. When do you plan to have the program up and running?
4. Do you think the setup process has gone smoothly so far?
5. What goals do you have for the bike sharing program?
6. Will your bike sharing include electric bicycles, traditional bicycles, or a mix of both?
   a. Do you think your colleagues are more likely to use one over the other?
7. What is your strategy for promoting the bike sharing program?
8. Do you have another type of transportation sharing scheme at your business? [if yes, answer parts a-c, otherwise, skip to 9]
   a. Do you predict that a bike share will compete with this other program?
   b. Do your goals for this program differ from your goals for bike sharing?
   c. Does your promotion of this program differ from your strategies for promotion of the bike sharing?
9. What positive feedback have you received from your colleagues about the idea for bike sharing, if any?

10. What negative feedback have you received from your colleagues about the idea for bike sharing, if any?

11. Have you seen any barriers towards motivating yourself and your colleagues to utilize the bike sharing? How could these barriers be overcome?
Appendix 4: Employer Have-a-Go Survey

Preamble

We are students from Worcester Polytechnic Institute in the United States. We are conducting research on bike sharing in collaboration with the University of Worcester. We would appreciate your feedback on your thoughts for this event. Your participation in this survey is completely voluntary and you may end the survey at any time or skip any questions you wish not to answer. This survey data will be kept anonymous and will only be used for research purposes.

Whilst your data is anonymous it will be managed and processed in accordance with applicable legislation including the Data Protection Act 1998 (DPA) and the General Data Protection Regulations (GDPR). Data will be held for up to 15 years. For the purposes of data protection legislation the University of Worcester is the Data Controller. The University's Data Protection Officer is the Head of Information Assurance infoassurance@worc.ac.uk.

Survey Questions

1. What did you like about the e-bikes experience (please select all that apply)?
   a. Bike was easy to use
   b. Easy to get up to speed
   c. Bike felt safe
   d. Took less effort than traditional pedal bike
   e. Other (please specify below)

2. What did you dislike about the e-bikes experience (please select all that apply)?
   a. Felt like I had less control than traditional pedal bike
   b. Pedal assist makes me less comfortable with the bike
   c. Had to put in more effort to control pedal assist
d. Faster than I would like

e. Other (please specify below)

3. Please specify your level of agreement with the following statement, where 1 is strongly disagree and 5 is strongly agree: I would be interested in using an e-bike regularly to make business trips.

1 2 3 4 5

4. Please specify your level of agreement with the following statement, where 1 is strongly disagree and 5 is strongly agree: I would be interested in using an e-bike regularly to commute to work.

1 2 3 4 5

5. Please provide any additional feedback you may have.
Appendix 5: Student Interview Script

Preamble

We are a group of students from Worcester Polytechnic Institute (WPI) in the United States. We are conducting research on bike sharing in collaboration with the University of Worcester’s Sustainability Department. We appreciate your time sharing your opinions with us. Your identity will remain confidential and your answers will remain anonymous. You may withdraw from this interview at any time or skip any questions you do not wish to answer. This interview will take less than 5 minutes.

Screening Questions

1. Are you currently a student at the University of Worcester? [if no, terminate]
2. Have you ever used the Woo Bikes program? [if yes, terminate]

Interview Questions

1. What is your usual mode of transport for commuting to and from campus/classes?
2. About how long does this commute usually take?
3. Are you aware of the Woo Bikes program offered on campus? [if yes, go to question 4, if no, go to question 5]
4. Have you considered using the Woo Bikes program? If so, what factors influenced your decision to not use it? [go to question 6 next]
5. Would you be interested in using an electric bike share program as part of your commute? Why or why not?
6. Is there anything you would like to see change that would make you reconsider using the program? Improved safety, facilities, etc.?
7. If there were an event to test out the e-bikes, would you be interested in attending?
Follow-up Questions: Riders

1. What did you particularly like about the e-bike experience?
2. What did you particularly dislike about the e-bike experience?
3. Would you be more likely to use a bike share if it offered e-bikes? Why or why not?
4. Would you be interested in using Woo Bikes after this trial? Why or why not?
5. Please provide any additional feedback you may have.

Follow-up Questions: Non-riders

1. Why did you choose not to ride the bike?
2. How could we get you to be more likely to try the bike?
Appendix 6: Stack Rack Bicycles Stakeholder Interviews

Preamble

We are students from Worcester Polytechnic Institute in the United States. We are conducting research on bike sharing in collaboration with the Sustainability Department at the University of Worcester. We appreciate you taking the time to share your thoughts. Your participation in this interview is completely voluntary and you may end the interview at any time or skip any questions you wish not to answer. Should we use any information from this interview in our final report, we will give you an opportunity to review the materials prior to publication. You may request for us to paraphrase your responses rather than directly quoting them.

Interview Questions: Dr. Carey

1. What inspired you to create Stack Rack Bicycles?
   a. What advantages do you believe Stack Rack Bicycles will provide as compared to traditional bike shares?
2. What do you believe are the primary barriers to bike shares or cycling in general? How can those be overcome?
3. How far along is the process of implementing Stack Rack Bicycles?
4. How has the implementation process gone thus far?
   a. What have been the major roadblocks to overcome?
   b. What has helped towards success?
5. Do you have existing information regarding opinions of your Stack Rack Bicycles system that we may use?
6. What types of commuter information do you believe would be most beneficial for us to gather?
Interview Questions: Jon Harris

1. Why do you wish to implement the Stack Rack Bicycles system?
2. How has the implementation process gone thus far?
   a. What have been the major roadblocks to overcome?
   b. What has helped towards success?
3. To what scale do you intend to construct Stack Rack Bicycles infrastructure?
4. Do you have existing information regarding the travel habits of commuters that we may use?
5. What types of commuter information do you wish to gather?
Appendix 7: Stack Rack Bicycles Interest Survey

Preamble

We are students from Worcester Polytechnic Institute in the United States. We are collaborating with the University of Worcester to conduct research on a proposed bike booking scheme between campus and Worcester train stations. We would be grateful if you would take 2 minutes to complete this anonymous survey. We may also use this data in academic journals and conference proceedings. Your participation is voluntary; you may exit the survey at any time. Data may be used in academic papers or presentations.

Whilst your data is anonymous it will be managed and processed in accordance with applicable legislation including the Data Protection Act 1998 (DPA) and the General Data Protection Regulations (GDPR). Data will be held for up to 15 years. For the purposes of data protection legislation the University of Worcester is the Data Controller. The University's Data Protection Officer is the Head of Information Assurance infoassurance@worc.ac.uk.

Travel Questions

1. Which campus do you spend the most time on?
   a. St. John’s
   b. Riverside
   c. City

2. How many days a week do you typically commute to campus?
   a. 1
   b. 2
   c. 3
   d. 4
   e. 5+
3. What is your primary method of transportation to commute to campus?
   a. Car
   b. Train
   c. Bicycle
   d. Walk
   e. Bus
   f. Other (please specify)

4. How long (in miles) is your typical commute from home to campus?
   a. Less than 1 mile
   b. 1-5 miles
   c. 5-10 miles
   d. 10-15 miles
   e. 15-20 miles
   f. Longer than 20 miles

5. How often do you commute to campus via Worcester Foregate Station?
   a. Daily
   b. 2-3 times a week
   c. Once a week
   d. 2-3 times a month
   e. Once a month
   f. Occasionally
   g. Never

6. How often do you commute to campus via Worcester Shrub Hill Station?
   a. Daily
   b. 2-3 times a week
   c. Once a week
   d. 2-3 times a month
   e. Once a month
   f. Occasionally
   g. Never
7. Stack Rack Bicycles is a service that would allow you to use an app to pre-book a bicycle for free for a full day upon arrival at your destination train station. How likely would you be to use this type of service? Please explain your response.
   a. Very likely
   b. Likely
   c. Neutral
   d. Unlikely
   e. Very unlikely

8. If you currently drive to campus, would you consider using the train if there were bookable bikes to complete your journey? Why or why not?

Demographic Information

1. With which gender do you typically identify?
   a. Male
   b. Female
   c. Other

2. What is your year of birth?
Appendix 8: Promotional Event Survey for Riders

Preamble

We are students from Worcester Polytechnic Institute in the United States. We are conducting research on bike sharing in collaboration with the University of Worcester. We would appreciate your feedback on your thoughts for this event. Your participation in this survey is completely voluntary and you may end the survey at any time or skip any questions you wish not to answer. This survey data will be kept anonymous and will only be used for research purposes.

Whilst your data is anonymous it will be managed and processed in accordance with applicable legislation including the Data Protection Act 1998 (DPA) and the General Data Protection Regulations (GDPR). Data will be held for up to 15 years. For the purposes of data protection legislation the University of Worcester is the Data Controller. The University's Data Protection Officer is the Head of Information Assurance infoassurance@worc.ac.uk.

Survey Questions

1. [Please choose all that apply] What did you like about the e-bike experience?
   a. Bike was easy to use
   b. Easy to get up to speed
   c. Bike felt safe
   d. Took less effort than traditional pedal bike
   e. Other (please specify)

2. [Please choose all that apply] What did you dislike about the e-bike experience?
   a. Felt like I had less control than traditional pedal bike
   b. Pedal assist makes me less comfortable with the bike
   c. Had to put in more effort to control pedal assist
d. Faster than I would like

e. Other (please specify)

3. Please specify your level of agreement with the following statement, where 1 is strongly disagree and 5 is strongly agree: I would be more likely to use a bike share if it offered e-bikes.

    1  2  3  4  5

4. Please provide any additional feedback you may have.
Appendix 9: Promotional Event Survey for Non-riders

Preamble

We are students from Worcester Polytechnic Institute in the United States. We are conducting research on bike sharing in collaboration with the University of Worcester. We would appreciate your feedback on your thoughts for this event. Your participation in this survey is completely voluntary and you may end the survey at any time or skip any questions you wish not to answer. This survey data will be kept anonymous and will only be used for research purposes.

Whilst your data is anonymous it will be managed and processed in accordance with applicable legislation including the Data Protection Act 1998 (DPA) and the General Data Protection Regulations (GDPR). Data will be held for up to 15 years. For the purposes of data protection legislation the University of Worcester is the Data Controller. The University's Data Protection Officer is the Head of Information Assurance infoassurance@worc.ac.uk.

Survey Questions

1. [Please choose all that apply] Why did you choose not to try the bike?
   a. Currently busy, not enough time
   b. Lack of cycling infrastructure
   c. Not confident in own cycling ability
   d. Other cycling safety concerns (please specify)
   e. Not interested in cycling (would rather walk, drive, etc.)
   f. Already have my own bike
   g. Other (please specify)

2. How could we get you to try the bike?
   a. Better location
b. Better timing

c. More information/advanced notice

d. Giveaways

e. More safety features

f. Athletic clothing available to borrow

g. Tie-ins with other campus events

h. Other (please specify)

3. Please provide any other recommendations you may have.
Appendix 10: Sample Infographic for Managers

The WOO Bikes Program is Distributing Pedal Assist Bikes to Local Employers

The University of Worcester will provide your business with a specified number of electric e-bikes, free of charge.

E-bikes provide a quick, environmentally friendly method of making business trips without breaking a sweat.

The University can help organize Have-a-Go sessions and assist with program management strategies.
Appendix 11: Example Employer Manual Outline

The manual for employers looking to set up bike pools would be based on “A Guide to Setting up a Bike Pool” from Cardiff Council Travel Planning Resources and “Pool bikes for business” from Transport for London.

Table of Contents

1. Introduction
2. Background
   a. What is a bike pool?
   b. Who is this guide for?
3. Benefits
   a. Benefits to employer
   b. Benefits to staff
4. Barriers
   a. Institutional barriers
   b. Personal barriers
5. Setup
   a. Management approval
   b. Planning and assignment responsibility
   c. Bike and infrastructure acquirement
   d. Launch, promotion and monitoring
6. Additional help and relevant organizations
Appendix 12: Example Stack Rack Bicycles Promotional Flyer

The flyer on the left is targeted at staff members who commute daily, while the flyer on the right is targeted at students who may commute via train only once a week or once a semester.

Image sources

- Permission for photo on top granted by Stack Rack Bicycles Ltd.
- https://commons.wikimedia.org/wiki/File:Google_Maps_pin.svg