Executive Summary

Issues
1.1. Oxford faces a number of challenges in relation to traffic congestion and adequate space for bicycle parking. An issue is whether a mass automated bike share scheme would be a feasible option for the University.

1.2. Oxford already has a high level of bike ownership – 22% of residents cycle at least three times a week. An issue is whether people would be willing to shift to a cycle sharing scheme.

1.3. Few publically administered bike sharing schemes have successfully operated as self-funding enterprises. An issue is whether an adequate level of public subsidy and sponsorship could be obtained. Other factors to consider in relation to the business model include:
   1.3.1. If the University could engage Colleges and Departments if proposing a bike share scheme.
   1.3.2. Whether the existing Oxonbike pilot scheme could be expanded to include stations in the city centre, near Colleges and Departments.
   1.3.3. Whether individuals would be more attracted to use the sharing scheme if ebikes were available.

Recommendations
2.1. Although challenges exist in developing a viable business model, there is enormous potential for the University to develop a bike share scheme in association with the Colleges.

2.2. If significant consensus is gained from Colleges and Departments, research should be conducted into the feasibility of using geofencing technology for the scheme. This involves parking bikes in a “virtual perimeter”, rather than constructing visible docking stations.

2.3. A large scale ebike share scheme is not suitable for Oxford. However, Departments or Colleges may wish to look into having a couple of bikes available for long distance rides or uphill journeys.

2.4. More research is required about cycle behaviour, the willingness of students/staff to cycle and individual perceptions of using bikes in a share scheme.
Introduction

Mass Automated Bike Sharing (MABS) schemes offer a network of automated bike docking stations, located at high density across an urban area. Such schemes can either function as a form of public transport, or a “feeder”, complementing existing transport networks. In complementing existing systems, MABS connect users to existing public transport networks, addressing the “last mile problem” in a commuter’s journey. This constitutes the distance from the transportation hub (Eg. Bus stop), to their final destination. Strategically locating MABS stations near public transport stops can increase the attractiveness of public transport, promote a cycling culture and open up parts of the city which were previously challenging to access. Furthermore, the schemes can remove barriers which prevent people from cycling regularly, including bike maintenance and parking.

MABS schemes have potential to reduce energy consumption in urban transportation. Although there is no clear evidence that existing schemes have produced such outcomes, potential exists if the scheme is integrated into the wider multi-modal transport system. Attention also needs to be given to behavioural and social factors, influencing an individual’s likelihood to use a MABS scheme. For example, usage demographics, costs of using the scheme, perceptions of distance and opinions of cycling safety.

For the University of Oxford, an issue is determining the tipping point which is needed to introduce such a scheme. As few, if any, publically administrated schemes have been able to operate as self-funding enterprises, consideration needs to be given to the level of public subsidy and sponsorship that could be obtained. As with the current Oxonbike scheme, operational efficiencies, both public and private investment, and network size need to be appropriate for the scheme to be a viable transport alternative. This is especially the case given that 22% of Oxford residents cycle at least three times a week (CTC Cycling Statistics). Subsequently, a high level of bike ownership can be hypothesised, a factor that could influence the success of a MABS scheme. However, comparing existing sharing schemes worldwide and current systems in the university context will be valuable in determining whether such a scheme could be a feasible option to meet the University’s needs.

![Figure 1 – Oxonbike docking station in the Science Area.](image-url)
How do the majority of MABS work?
Most sharing schemes provide a “turn-up and go” hire system on a short term basis. An annual subscription or membership fee provides access, with the first 30 minutes of hire typically free. Upon subscription, the user receives a PIN, enabling them to rent a bike at a sharing station. Most schemes allow the user to return the bike to any docking station. If a dock is full, the commuter is usually either given time to travel to another available station (Eg. Santander Cycles) or can lock the bike elsewhere, with the bike later redistributed to another station (Eg. Oxonbike).

Figure 2 – Santander Cycles scheme in London

Figure 3 – Oxonbike “Mobile Version”. Commuters are able to access a station map on the Oxonbike website, which indicates the number of bikes available at each station. This tool is particularly valuable, assisting commuters in planning their journey.
In preparing this report, a number of different MABS were researched, with a focus on operational design and user practicality. The following schemes listed in the table were highlighted as share schemes of relevance to the context of this project:

<table>
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<tr>
<th>Scheme Description</th>
<th>Details</th>
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| **Oxonbike, operated by HourBike Ltd (Figure 1)**                                | - Self-service bike hire scheme, with 10 stations  
- Scheme network created by “Oxford County Council, with partners Oxford Health NHS Foundation Trust and the University of Oxford”.  
- Annual subscription available online.  
- Online “mobile version” shows station availability *(Figure 3)*.  
- Pricing: £1 per year, free for the first 30 minutes then incremental pricing scale.  
- No helmets provided.  
- When docking station is full, the spare lock can be used to attach the bike elsewhere. Other share programs do not offer this and the user is responsible for finding an available station (Eg. Santander Cycles). |
| **Brompton Dock (Oxford Station)**                                                | - Commenced March 2015  
- Folding bikes available for hire 24/7  
- Advantages of folding bikes: Can be taken on public transport, placed under a desk at work and easily stored.  
- Students and staff at Oxford can get 20% off annual membership.  
- Pricing: £2.50 per day, £20 per year  
- Currently 24 docks across the UK  
- Different from other schemes, as the bike can be hired for as long as needed. |
| **Santander Cycles (London) (Figure 2)**                                          | - Contracted by Transport for London to Serco  
- Based on Velib system in Paris  
- 11 500 bikes, 742 stations  
- £140 million for planning and implementation over six years  
- Commenced in 2010  
- Information available in different languages at stations.  
- During high load hours, bikes are moved from the busiest stations to the emptiest using trailers pulled by electric vehicles with zero CO2 emissions. However, some local councils have refused to allow Serco to move bikes around at night due to residential noise concerns.  
- 44% of income comes from “late return” fees  
- 90 000 users registered 1 million rides in first 10 weeks of operation  
- Issues with bikes being too heavy at 23 kg. |
Existing MABS serving the university context

Research highlighted two schemes currently serving staff and students in a university context. Both of these schemes were operated by an external provider rather than being run in-house. Running the scheme in partnership with a commercial operator, could provide efficiency, cost and practicality benefits.

| Bath Spa University MABS, in partnership with Nextbike | - Correspondence with a Transport Officer at Bath Spa University indicated that Nextbike was selected to operate the scheme because they were the only realistic local supplier.  
- Bikes available at 8 locations. Bikes can be returned to any of these locations.  
- Free subscriptions for students and staff, first 40 minutes free.  
- Online registration is required. |
|---|---|
| Yale University MABS, in partnership with Zagster | - Zagster overseas all aspects of the bike sharing program, providing maintenance and 24/7 rider support.  
- 50 share bikes, 10 locations  
- Students register with Zagster and reserve a bike via the mobile site.  
- Bike must be returned to the same location.  
- Pricing: US$30 per year, but only US$10 if a Bike Safety Class is undertaken. Free for the first 4 hours and US$3 for each additional hour. |


Informational available at: [http://to.yale.edu/bikeshare](http://to.yale.edu/bikeshare)
A number of universities were also contacted about whether they had previously considered implementing a MABS scheme. Adam Taylor (ANUGreen Sustainability Officer) indicated that the University had previously looked into a mass bike share scheme, although did not consider it a suitable option, given the high levels of student/staff bike ownership. This is similar to the situation facing the University of Oxford. In my correspondence with Adam, he mentioned the “Social Bicycles” share scheme which has been implemented by Monash University in Melbourne (http://monashbikeshare.com/). 70 bikes are currently available through the scheme. Bikes are reserved through a mobile app and can be returned to a rack at any hub location.

Departmental bike share schemes are also popular within the university context. For example, The Malthouse has a number of share bikes available for employees to travel to meetings and appointments. Similarly, the Australian National University has a scheme known as “Timely Tredlies”. This scheme provides staff members with access to bicycles for intra-campus travel, with 100 bikes currently available through the program (https://services.anu.edu.au/campus-environment/transport-parking/timely-tredlies-departmental-bicycle-program).

**Other schemes**

In addition to MABS schemes, there are a range of other bike share formats. Given that a MABS scheme often requires considerable funding and the development of a business model, the University might be interested in considering other bike loan programs.

The Bicester Bicycle Loan Scheme is a free cycle loan program, encouraging people to reduce private automobile travel. A range of bikes are available through the loan scheme, including folding bikes and children’s trailers. The scheme is part of the “Cycle for Bicester” program which also includes a four week loan scheme (http://www.ecobicester.org.uk/cms/content/cycling#.VbogXPlViko). The University might be interested in the operation of such a scheme, given that there is potential to run a cycle loan scheme for students during the academic year. Students could be loaned a high quality cycle for a small fee, which would also give them access to cycle maintenance and repair services.
Is there a need for a fully electric (ebike) fleet?
A fully electric fleet is not necessary, given that the majority of journeys in Oxford are likely to be of short distance, between colleges, teaching and research sites in the city centre. However, having ebikes available could be beneficial for travel to Old Road Campus and Hospitals in Headington. Subsequently, having a mix of both conventional and ebikes could be useful. A mixed fleet with a greater proportion of conventional bikes might be more suitable and cost effective.

![Figure 3 – Yellowbike’s “Gobike” electric bike.](image)

Yellowbike is the UK distributor of the Gobike technology used in Copenhagen’s mass bike share scheme. A robust military grade tablet allows the user to access maps and travel information. A representative from Yellowbike visited The Malthouse during my internship. It was interesting to hear about the specifications of the bike and have a “test ride”! [http://www.yellowbike.biz/welcome/](http://www.yellowbike.biz/welcome/)

Would a MABS scheme be a feasible transport option for Oxford?

Current scope and criteria for success
A proposed MABS scheme for the University of Oxford would serve over 22 000 students and 12 000 staff.

Factors to consider in the construction of a mass share scheme include:

- Target audience, user profile and whether the scheme would include tourists or be solely for staff/student use.
- Subscription fees and business model
- Type of bicycle – conventional or e-bikes
- Sponsorship
- Maintenance
- Location of bike sharing stations and number of bikes
- Involvement of Colleges and Departments
- Relationship to the existing Oxonbike scheme, County and City Councils.
First generation Oxonbike scheme

The current Oxonbike scheme has been in its present format since April 2014 and is operated by HourBike. Previously the scheme was operated by Grand Scheme Bike Share Ltd, using BYKER technology. This technology enabled the scheme to be facilitated without requiring the construction of docking stations, creating a system that was light on infrastructure. Bicycles incorporated a solar powered GPS tracker, enabling bikes to be parked in a geofenced area or “virtual perimeter”, registering return. However the initial operator, Grand Scheme Bike Share went into liquidation, resulting in the scheme being relaunched in April 2014.

The present form of the Oxonbike scheme includes fixed docking stations, rather than allowing bikes to be parked within a geofenced area. Although the movement away from the GPS and GSM communication technology on individual bikes could reduce costs, fixed docking infrastructure could be perceived as space consuming. However, correspondence with Tim Caswell, the Managing Director of HourBike, suggested that the fixed docking infrastructure approach is likely to remain. He indicated that having a “smart bike” system would require each bike to feature complex communications capability and a digital lock. As technology in this area is rapidly changing, there would be costs involved in upgrading technology. Currently, there is only one communications module required per station, reducing vulnerability and costs. Subsequently, having individual bikes fitted with communication capabilities would impact the system if a bike was lost or vandalised.

Tim also suggested that a geofenced approach can create a number of operational issues. For example, the bikes might not be visible all the time, due to poor signal levels, shielding or interference. There are also issues associated with the ongoing power requirements for communication modules on “smart bikes”. Furthermore, Tim felt that the visibility of infrastructure brings a certain presence to the scheme. Although bikes could be branded (Eg. Santander Cycles), visible infrastructure provides opportunity for advertising and might be more attractive to a potential sponsor. As a result, docking stations can be viewed as a valuable marketing asset of the scheme.

For more information:


http://www.oxfordshireguardian.co.uk/oxonbike‐set‐for‐headington‐return/
### Brainstorming the Benefits and Challenges of MABS

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<tr>
<th>Benefits</th>
<th>Challenges</th>
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<tr>
<td>• MABS schemes simultaneous address environmental, economic and health outcomes.</td>
<td>• Ongoing costs – maintenance and redistribution often accounts for over 80% of the overall costs of the scheme, according to Nextbike.</td>
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<td>• MABS encourage physical exercise, with potential to reduce the health costs of obesity and a sedentary lifestyle. Obesity costs NHS £1.1 billion annually.</td>
<td>• Few, if any, schemes have successfully operated as self-funding enterprises.</td>
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<td>• Effective transport option that can be implemented as cities move away from “car-centric city planning”.</td>
<td>• Behavioural and social barriers to usage – Eg. Usage demographics, costs of using the scheme, perceived distances and opinions on cycling safety.</td>
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<td>• Potential to reduce energy consumption and substitute for more energy intensive methods of transport.</td>
<td>• Urban planning challenges – Eg. Determining locations of bike stations, analysing generators and attractors, distinguishing transport hubs and considering both leisure and commuter use. However, this could be overcome by locating docking stations on University land, providing secure, private stations for sole use by students and collegiate staff.</td>
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<tr>
<td>• Relieves cycle parking pressure, fly-cycle parking, clutter and abandoned bicycles.</td>
<td>• Alerting commuters to the availability of bikes at each station. Although this can be overcome by online sites/App – Eg. Oxonbike</td>
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<tr>
<td>• Alleviates the demand for cycle parking in the city centre, decluttering street space around the Colleges and the University’s functional estate.</td>
<td>• Majority of MABS schemes include fixed docking stations. However, removing docking stations and “making the bike intelligent, rather than the locking infrastructure” could overcome this. Eg. BYKER technology on initially operated Oxonbikes by Grand Scheme Bike Share</td>
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<tr>
<td>• Assists in meeting the University’s business travel needs. For student’s this involves connecting their place of residence (38 colleges) with teaching and research areas. For staff, connecting the University’s functional estate.</td>
<td>• Bicycle quality – MABS scheme bikes must have a “wear and tear” factor, enabling the bike to be adaptable and function in different weather conditions. However, using a durable bike could be too heavy. Eg. Argument that Santander Cycles are too heavy at 23kg.</td>
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<td>• Potential to negotiate with Colleges for the purchase of “goldcards” for students, perhaps at a discounted rate but providing a constant revenue stream.</td>
<td>• MABS might not be completely successful in alleviating the demand for cycle parking and improving aesthetics. There is already a high level of bike ownership in Oxford, meaning</td>
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<tr>
<td>• Improves student experience, providing access to quality bikes, rather than students having to buy their own, potentially old and unsafe bikes</td>
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<td>• Increase the attractiveness of public transport, through complementing existing transit networks</td>
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<tr>
<td>• A MABS scheme aimed at university students</td>
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IARU Sustainability Fellowship  10
could be successful in attracting sponsorship. Similar to “Boris bikes” sponsored by Santander in London.

- Implementing a MABS scheme would allow the University to act as a leading partner, in a consortium with other stakeholders – Oxford Brookes University, Oxford Health, NHS Foundation Trust, Oxford University Hospitals NHS Trust, County Council and the City Council.

- Provides a transport option, available 24/7, with capacity to improve the resilience of Oxford’s transport network.

that people might not be willing to change to a MABS scheme. A guaranteed, captive market might not emerge.

- Difficulties could emerge in negotiating with Colleges and encouraging them to participate in the uptake of the scheme. Colleges are independent, so persuading them to provide a discounted rate to students for a MABS scheme use could be challenging.

- Challenges building a “resilient scheme”. This involves how the scheme would cope with unpredictable events, failure, extreme weather events and major traffic congestion.

### Determining the location of MABS docking stations

A feasibility study would need to be conducted in association with a consultant about the optical location for bike sharing stations. As scheme success is heavily dependent on the location of stations relative to major attractions and transport hubs, it would be valuable to engage an independent consultant. A GIS multi-criteria evaluation type approach could be used, including different factors which could affect the success of a potential location. See, for example, Garcia-Palomares et al. (2012).

Otherwise, the location of stations could be discerned based on the willingness of local shops or businesses to provide sponsorship and funding. For example, a station could be prioritised for construction near a specific business, if they were willing to make a significant financial contribution to the construction of the scheme.
Recommendations

Recommendation 1: Although challenges exist in developing a viable business model, there is enormous potential for the University to develop a bike share scheme in association with the Colleges.

Action: Begin discussions with Colleges about whether they would be willing to partake in such a scheme. These consultations would be lengthy, but would be useful in evaluating the extent and willingness of College support. Consultations would also be valuable in understanding whether any Colleges already have small scale or informal bike share programs in place (Eg. “Timely Tredl”ies” program at ANU)

Justification: Despite bike share schemes being expensive and few schemes operating as successful self-funded enterprises, there are other benefits which should not be discounted. These include reduced congestion and health benefits. The HEAT tool is a valuable indicator to use. From the Oxonbike data, the HEAT calculator (using average per person or total observed across a population) determined that £8000 total health benefits would be accumulated from 1 year of scheme use.

Recommendation 2: If significant consensus is gained from Colleges and Departments, research should be conducted into the feasibility of using geofencing technology for the scheme. This involves parking bikes in a “virtual perimeter” rather than investigating in fixed infrastructure docking stations.

Action: Talk with bike share schemes about their experience using geofencing technology. Evaluate the operational and technical requirements of using communication modules (GPS, GSM) on bikes.

Justification: Parking the bike within a geofenced area would save space, rather than having to construct space consuming and expensive docking stations.

Recommendation 3: A large scale ebike share scheme is not suitable for Oxford. However, Departments or Colleges may wish to look into having a couple of bikes available for long distance rides or uphill journeys.

Action: Gain consensus from Colleges and Departments about whether they currently own any e-bikes or would find them valuable. Again, this would be a length period of consultation. However, if enough support is present, the University could consider placing funding bids to purchase ebikes. More research would need to be conducted about the most suitable ebike model. For example, the model presented by Yellowbike was heavy, expensive and was mainly targeted at the tourist audience.

Justification: E-bikes do have advantages, make making long journeys easier and may encourage less-confident cyclists.
**Recommendation 4:** More research required into cycle behaviour, the willingness of students/staff to cycle and individual perceptions of using bikes in a share scheme.

**Action:** Engage a consultant to determine the willingness of commuters to participation in a bike share scheme. Factors including the optimal location of bike sharing stations could also be considered in the analysis.

**Justification:** Research will provide more support for a funding bid proposal.
References
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