UNIVERSITY of York

"Strategies towards achieving low carbon and high-value added from the economic sectors in North Yorkshire"

A report for the North Yorkshire County Council

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14th October 2022

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Executive Summary

The journey to Net Zero in the UK is well underway. Net Zero is achieving a balance between the addition and the removal of CO_2 emissions to/from the atmosphere from human activities to stop global warming.

This research was commissioned by North Yorkshire County Council to continue previous work on "Low carbon infrastructure and business growth". This report explores the current progress by businesses in North Yorkshire towards the Net Zero goals, including their current practices, the opportunities and challenges that they face, as well as unveil the divergences in understanding when aiming towards a low carbon and high-value economy. The research was carried out from February to September 2022.

First, a qualitative methodology consisting of semi-structured interviews with managers of local businesses, both online and face-to-face, was employed. Second, a quantitative methodology consisting of a survey questionnaire was used, the survey was distributed via Qualtrics to a wider set of managers of local businesses.

The recommendations to the North Yorkshire County Council, from the research reported here, are summarised below.

-Increase the level of awareness and provide some more guidance to reach Net Zero

- Improve the awareness of companies by designing measures to share good practices and provide sectoral advice, i.e. to identify good practices towards attaining Net-Zero goals based on sectoral analysis and disseminate them to organisations.
- The government can develop plans to work in partnership with large organisations as sector leaders, which have successful Net Zero carbon strategies implemented where they can share their experiences to the organisations in their sector.
- Set up a specific "Net Zero Goal Office", where companies can get in touch to make related enquiries, e.g. general information, technical advice, funding, etc.

- Promote further research to understand the sectoral progress to achieve Net Zero

- There needs to be a better understanding of the sectors depending on their nature, the challenges they face and the opportunities available for the sectors.
- There seems to be some confusion among businesses on what can be done and not done especially in terms of '*heritage'* buildings.
- Policies need to be designed to be clearly communicated to the sectors, further research should be carried out on each sector to understand:

✓ The enablers/barriers organisations face when implementing their Net Zero strategy.
✓ The opportunities/challenges they face to effectively implement their Net-Zero strategy.

- Provide further government financial support and motivation towards Net-zero strategy

- Develop funding opportunities to help organisations moving towards Net-Zero strategy.
- Design and develop attractive incentives for organisations which attain each level of Net-Zero goals.
- Time seems to be another constraint for the organisations to focus on the Net zero strategies. Therefore, specific support groups, which can include Communities of Practices and expert panels should be organised to provide Net Zero assessment for organisations in each sector.

Keywords: Net Zero, low carbon, carbon neutral, high value, policy, North Yorkshire.

List of Abbreviations

CE: Circular Economy

EV: Electric Vehicles

FAME: Financial Analysis Made Easy

GVA: Gross Value Added

LED: Light Emitting Diode

NYCC: North Yorkshire County Council

1. Introduction

1.1. Motivation

This report builds upon a previous project on “Low carbon infrastructure and business growth” carried out in collaboration between the University of York and North Yorkshire County Council (NYCC). The period of study was between mid-February and end-September 2022.

The previous project unveiled three clusters within which the economic sectors in the North Yorkshire Economy were classified. These clusters emerged from a combination of high/low value added to the economy vs. high/low carbon dioxide (CO_2) emissions (Huaccho Huatuco *et al*., 2021), namely:

- Cluster A = Low carbon emissions, Low GVA added, Low level of employee jobs and Low number of private businesses,
- Cluster B = High carbon emissions, High GVA added, High level of employee jobs and Low number of private businesses, and
- Cluster C = Low carbon emissions, High GVA added, High level of employee jobs and High number of private businesses.

This project, entitled “Strategies towards achieving low carbon and high-value added from the economic sectors in North Yorkshire” builds upon those previously identified clusters, and collects primary data from businesses in North Yorkshire across the focus sectors, as prioritised by the NYCC representatives at the beginning of this second phase, see ***Table 1.***

The research objectives are:

- To gain insight into the main challenges/opportunities and enablers/barriers across organisations in the economic sectors prioritised by the NYCC.
- To discover what knowledge these organisations have about net zero emissions targets, how they use their knowledge to achieve low carbon targets, what work they do and how their work to reduce carbon emissions has evolved over time.
- To unveil divergences and/or contradictions within organisations that are central to achieving low carbon emissions targets and high-value added across economic sectors prioritised by the NYCC.

Table 1: *Focus sectors in the North Yorkshire economy and Clusters*

Focus Sector	Cluster
Digital and creative industries, e.g. screen industries	A
Manufacturing - sub divided into advanced manufacturing/ engineering and food manufacturing	B
Visitor Economy / Hospitality – which would include retail, catering and accommodation	C
Food production – mainly concerning agriculture	C

The four sectors above were researched using a combination of qualitative and quantitative methodologies, the participants were managers of organisations working within those sectors and that were registered in the North Yorkshire region.

The remainder of the report is organised as follows. Next section 1.2 presents the Net Zero challenge at UK level and at North Yorkshire region level. In Section 1.3, the economic structure of the North Yorkshire region is provided. Section 2 shows the methodology followed in the research. Section 3 the analysis of results is presented. Finally in Section 4, some conclusions and recommendations are provided.

1.2 The Net Zero Challenge (in The UK and North Yorkshire region)

The UK Government has set out the target of achieving Net Zero by 2050, this was ratified in the COP26 in Glasgow (UKCOP26.org, 2021). Net Zero is the target of balancing out carbon dioxide (CO_2) emissions to and from the atmosphere to stop global warming (Oxford Net Zero, 2022). To do this, the UK Government has set out towards reducing CO_2 emissions by 78% of 1990 levels by 2035 (Harvey, 2021).

Due to its relatively large rural geographical area, the North Yorkshire region has the potential to achieve Net Zero by 2034 and to become the first carbon negative region in the UK by 2040 (York and North Yorkshire Local Enterprise Partnership, 2022). Therefore, the North Yorkshire County Council has been actively engaging in several initiatives/projects in collaboration with different partners, e.g. Local Enterprise Partnership, University of York, York St. John University, Teesside University, etc. (University of York, 2022).

1.3 Economic structure in the North Yorkshire region

Main contributing economic sectors in North Yorkshire are: manufacturing, accommodation and food, as well as logistics and transport (North Yorkshire County Council, 2017). In 2020,

it was estimated there were over 58,526 registered companies in the region (Jefferson-Brown, 2020).

In terms of CO_2 emissions per capita in North Yorkshire, it has been estimated that they have steadily decreased from 7.6 (in 2014) to 5.8 (in 2020) Tons of CO_2 emissions per capita (LG inform, 2022). This is slightly above the mean of UK local authorities, however the difference between North Yorkshire region and the UK mean has remained steady over time at 0.9 Tons of CO_2 emissions per capita. See ***Figure 1.***

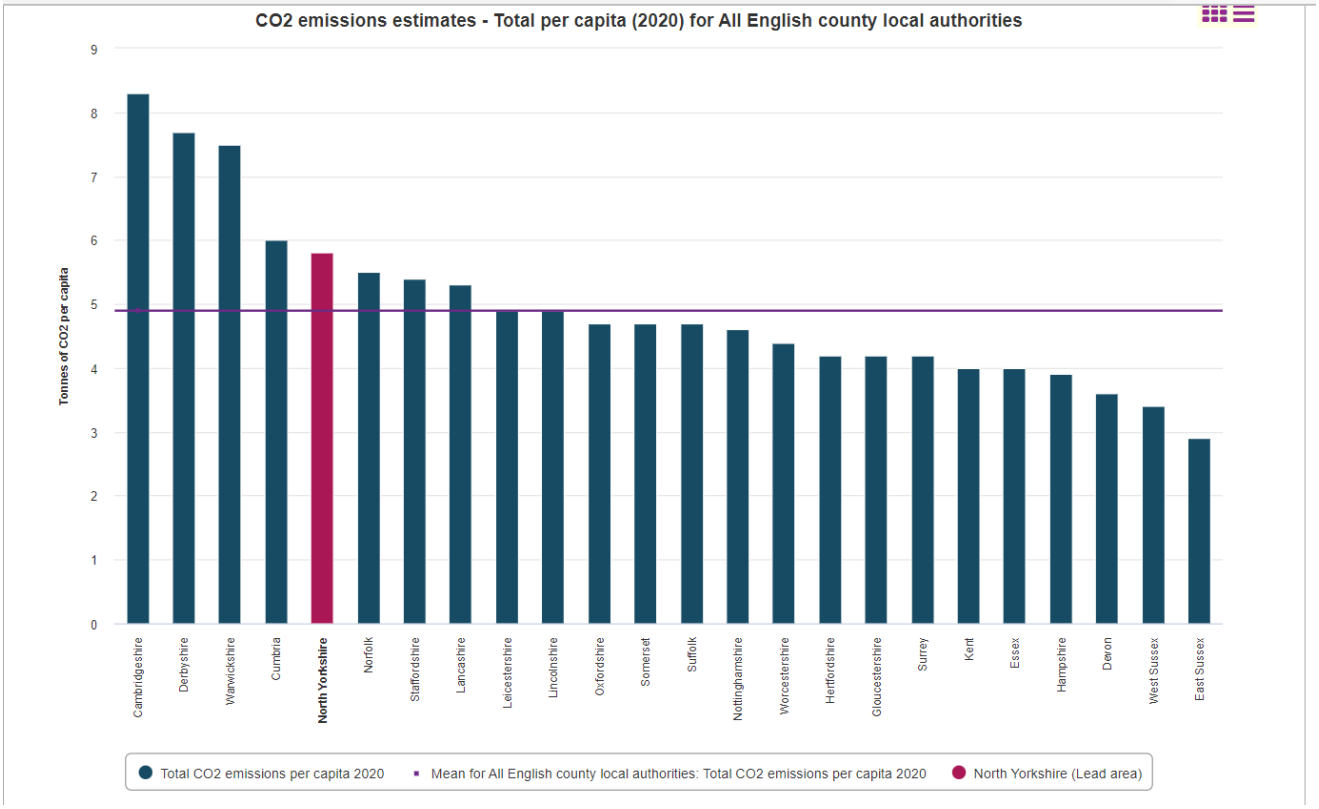

Figure 1: *CO_2 emissions in North Yorkshire (LG inform, 2022)*

The digital and creative industries (Cluster A) sector is regarded as one of the sectors that have potential for future growth in the next few years (York and North Yorkshire Local Enterprise Partnership, 2022). This sector includes: games, technology, digital media and film businesses from across the region (The Newsroom, 2018). In Yorkshire and the Humber the most prominent sub-sectors are: Architecture, Software, Performing Arts, Web Design, Internet Services, Interactive Leisure Software (UK Government, 2001).

In terms of CO_2 emissions by the digital and creative industries sector, there have been initiatives such as the one by Arup in creating a greenhouse emissions calculator for the arts and entertainment industry (Sunga, 2022).

In terms of **manufacturing (Cluster B)**, one of the main sub-sectors in North Yorkshire is **food and drink**, accounting for 19.4% of manufacturing output in the wider region of Yorkshire and the Humber (Make UK, 2022). Combining **farming (Cluster C)** with food **manufacturing (Cluster B)** into the **agri-food sector**, then the statistics from York and North Yorkshire Local Enterprise Partnership (2022) are as follows: 41,500 employees, representing an employment growth of 18.6% (2015-19), GVA was £1,781 million, representing 10% GVA growth.

According to Food and Drink federation (2021), the overall view of the manufacturing in the food and drink supply chains, with regards to CO_2 emissions is as follows: 32% come from UK (livestock and farming), 33% come from imports (production, packaging and transport), 3% from packaging, 6% from manufacturing, 5% from transport, 9% retail and catering, 12% from consumers, and 0.5% from post-consumers (food waste).

Another manufacturing sub-sector that is of interest to the NYCC is the **Advanced Manufacturing sector (Cluster B)**. This sub-sector has been defined as *"the use of innovative technologies and methodologies for improved competitiveness in the manufacturing sectors"* and has been grouped into efficient/intelligent production and effective organisation (TWI Global, 2022). It is closely related to Industry 4.0 and Internet of Things, mainly characterised by embracing the automation of manufacturing processes: from ICT, Data Analytics, Advanced Engineering and connectivity (Leicester LEP, 2022). Some sub-sectors that have been investigated are: automotive, aerospace, pharmaceutical, etc.

In terms of CO_2 emissions by the advanced manufacturing sector, it has been recognised that advanced manufacturing technologies, such as additive manufacturing and digital manufacturing require an increased use of energy and IT/digital resources. Some of the novel contributions to improve the link of this sector to sustainability are: low-fossil carbon process planning and production scheduling, integration of supply chain management innovations and advanced manufacturing as well as sustainable innovations for product-service systems (Jin *et al*., 2017).

The North Yorkshire region is well-known for its tourist attractions, which contribute towards what has been labelled as the **Visitor Economy sector (Cluster C)**, which provides a welcoming experience for visitors to the many museums, retail outlets, hospitality and accommodation venues. This sector generates £1.5 billion of visitor spend each year and supports 41,000 jobs (North Yorkshire County Council, 2017).

Due to the Covid-19 pandemic, this sector has been badly affected, with 67% reduction in the number of visitors to York (as an indicator) in October 2020 compared to the previous year (Atkins Limited, 2021). In terms of CO_2 emissions, this sector has been traditionally lower than other key sectors in the region, such as manufacturing and transport.

Food production (Cluster C) is also a key sector in the region. In 2019, DEFRA estimated that the value of the output from farming was £2.5 billion, with a total Income from Farming of £452 million. The biggest contributors to the value of the output were pigs for meat (£382 million), wheat (£324 million), poultry meat (£267 million) and milk (£208 million), which together account for 48% (DEFRA, 2019).

As for the types of farms in the region, grazing livestock farms and cereals farms form part of a third of the farmland area each. Although pig farms accounted for a much smaller proportion of the farmed area, the region accounted for 37% of the English pig population (DEFRA, 2019).

The agricultural sector is both a source and a sink of CO_2 emissions (NFU, 2022), some local authorities within North Yorkshire, e.g. Harrogate, are advocating tree planting and woodland/peatland creation (Harrogate County Council, 2021).

2. Methodology

2.1 The Approach of the Study

The findings in this report are based on primary data collection, namely: semi-structured interviews and survey questionnaires. The participants are managers of businesses registered in the North Yorkshire region, who have several years of working experience in their sector.

First, the semi-structured interviews explore the key issues of the research. This provides in-depth rich data from businesses in the focus sectors. These interviews were typically scheduled to last 30-45 mins for answering 30 questions. Most of the interviews were carried out online via zoom, whilst some were carried out face-to-face, mainly in the agricultural as well as the digital and creative industries sectors. The interviews were carried out between April and August 2022. The questionnaire was elaborated based on the main strategies and actions identified in the sector pathways to Net Zero, part of the Route map to Carbon Negative 2021 (York and North Yorkshire LEP, 2021).

Second, the survey questionnaire is designed to provide a wider exploration of the issues surrounding Net Zero. This survey was implemented in Qualtrics and distributed to the potential respondents, mainly from the Financial Analysis Made Easy (FAME) database. The survey consisted of 23 questions, and it was estimated that it would take 15 mins. for a participant to complete it. The survey was sent mid-August 2022, was made available until the end of September, with two reminders sent before the end of the survey.

See ***Appendix A*** and ***Appendix B*** for the questionnaires for the interviews and the survey, respectively. It is worth mentioning that prior to carrying out the data collection, these questionnaires were sent to the NYCC representatives, who provided feedback on the questions posed there.

2.2 Criteria for selection

The selection of participants followed a multi-phased selection. First, the research team used the FAME database to look for businesses in the North Yorkshire region as potential participants. Second, the NYCC representatives provided some business contacts based on their knowledge and experience of collaboration. Third, the research team looked for their own contacts and took initiative to proactively talk to businesses at conferences, seminars, visits, etc.

As a result, the selection of participants was mainly targeted, i.e. the criteria for selection were that the businesses should be registered in the North Yorkshire region and that they were operating in the focus sectors as identified by the NYCC.

2.3 Analysis tools

The analysis of the semi-structured interviews was done using NVivo version 12, which is a software that allows identifying the connections within the data given in the interview transcripts. It is a very useful tool to identify themes that emerge from the analysis. The use of NVivo was valuable as the number of interviews increased over time.

The survey questionnaire was designed in Qualtrics and distributed to by email. The survey data was analysed using MS Excel. This analysis was useful to achieve a greater generalisation of results provided that the sample is representative of the population of interest.

2.4 Ethics approval

Before collecting the data, this research project was subject to ethics approval by the Economics, Law, Management, Politics and Sociology (ELMPS) committee at the University of York, which provided valuable suggestions for improvement on the initial application. The main suggestions were in relation to anonymity of participants and protection of personal data collected. Approval was granted on 9th June 2022 (Application number 68/ELMPS/21-22).

3. Results

3.1 Interviews

This section depicts the findings derived from analysing the qualitative data collected from 18 semi-structured interviews with managers of organisations based in North Yorkshire to understand the NYCC regions' progress towards the Net Zero targets by 2034. The thematic analysis used NVivo 12 for the analysis of the qualitative data in this research.

The data was collected from participants in the zoom or direct interviews using a semi-structured interview guide. The list of companies is provided in ***Table 2***.

Table 2: *List of interviewees*

Pseudonym	Sector	Subsector	Position
Retail 1	Visitor Economy / Hospitality	Retail	Managing Director
Retail 2	Food Production	Retail	Innovation Manager Sustainability Manager
Retail 3	Visitor Economy / Hospitality	Retail	Managing Director
Museum	Visitor Economy / Hospitality	Museum	Chairman
Advanced Manufacturing	Manufacturing	Advanced manufacturing	Commercial Director
Engineering 1	Manufacturing	Engineering	Sustainability Manager
Engineering 2	Manufacturing	Engineering	QSHE Manager
Energy	Manufacturing	Energy	Senior Government Policy Manager
Accommodation 1	Visitor Economy / Hospitality	Accommodation	Chief Executive
Accommodation 2	Visitor Economy / Hospitality	Accommodation	Compliance and Procurement Director MWIFM
Estates 1	Visitor Economy / Hospitality and Agriculture	Estates	Estate Chief Executive Estate projects

Pseudonym	Sector	Subsector	Position
Estates 2	Visitor Economy / Hospitality	Outdoor Education - Estate	Head of Centre
Theatre	Digital and creative industries	Theatre	Operations Director
Media	Digital and creative industries	Media	Business Development Director
Cinema	Digital and creative industries	Cinemas	Cinema Experience Manager
Farming 1	Agriculture/ Rental	Farming	Director
Farming 2	Agriculture	Farming	Business Owner
Farming 3	Agriculture	Farming	Business Owner

The main themes derived during the data analysis are:

- Level of awareness in terms of Net zero goals set up by the NYCC
- Organisations' progress towards the Net zero goals set up by the NYCC
- Government support in moving towards net-zero

Further coding suggested sub-themes informing the research on the barriers and opportunities available for organisations in achieving Net Zero goals. ***Figure 2*** below shows these three themes and some of the resulting sub-themes.

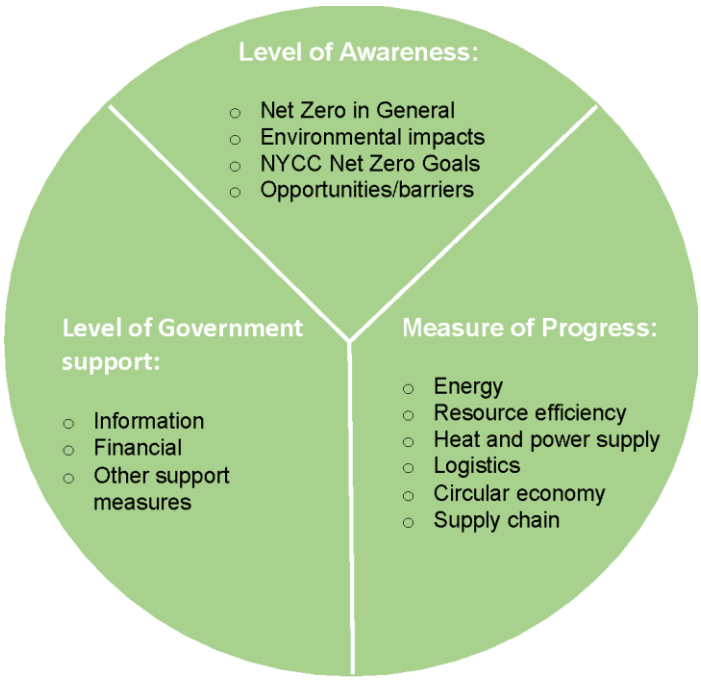

Figure 2: *Themes and sub-themes resulting from the analysis of interviews*

The specific findings under each theme are presented next.

Theme 1: Level of awareness in terms of Net zero goals set up by the NYCC

The main findings in this research suggested that the organisations were largely unaware of the Net zero goals set up by the NYCC**.** Only two large organisations said that they were aware of the Net zero goals, but most of the organisations in all the sectors explained having no idea of these goals set up by the NYC.

For instance, Accommodation 2 noted,

*"No. I'm not if I am honest. No, I wasn't aware of that. But that's really important for us to know. We are a big a big.. a big part of North Yorkshire." (*Accommodation 2*)*

Accommodation 2 is an organisation categorised in the visitor economy and they expressed their surprise when being explained the NYCC Net Zero goals despite them being *a big part of North Yorkshire.* This was understood to be a major obstacle for the organisations that are interested in improving their organisation decarbonisation strategy.

As the above narrative shows, very often the participants expressed their interest to know more about these Net Zero goals and how to progress towards them. To understand this further the organisations were asked regarding the meaning of Net Zero carbon to their organisations and the evidence further suggested that most of the participants have an understanding of the Net Zero relevance from a business and societal perspective. The

following extracts from the interviews explain the relevance of achieving Net Zero for these organisations from an economic perspective.

"A lot of our big customers are now asking us for documentation and asking us what we are doing with regards to Net Zero, so we are sort of having to sort of respond a bit and look into it for the first time." (Retail 1)

"I know from the bigger companies that we deal with, as our customers. They are challenging us on our supply chain. So you know, of the materials and suppliers that we use, you know, they are coming back down their supply chain to us, and then encourage us to loop back down our own supply chain." (Advanced Manufacturing)

"So, broadly speaking, from an economic perspective for us it means reducing emissions as close to zero as possible. I think it's really important to remember the 'Net' element of Net Zero." (Energy)

The narrative suggested that for the companies to stay competitive in the market they will have to take actions towards decarbonisation in a broader sense (i.e. Scope 1, 2 and 3). Similarly, the sustainability-focused customers who express their demands towards Net Zero approach were also found to play a role in the sustainability strategy of the organisations. Thus, the emerging theme suggested that the main reasons for some organisations to move towards decarbonisation include: the increased customer awareness in terms of sustainability initiatives, board member's demands, governmental regulations on decarbonisation and the sustainability strategies adopted by competitors in the market.

Furthermore, most of the participants reported the Net Zero strategies as a moral obligation towards society and the planet.

"I hope it's a goal for everybody in the whole world, you know it's very important for the future of the planet and for us as human beings to reach Net Zero, and I think we're moving very slowly as a country, and as a society, and we have to move quickly really, so certainly you know in our organisation, we don't want to be responsible for causing any damage to the planet." (Museum).

As the above extract shows the participants regarded reducing carbon emissions as of significance for the whole society and they show an understanding of their obligation towards future generations. The 'moral' dimension seemed to be an important aspect for the participants when the questions were raised on the meaning of Net Zero and its implications for the organisation. Society on large and planet appeared to be constantly mentioned when addressing these questions. However, the level of awareness was not stemmed from governmental initiatives to raise awareness, but from general sources including television news, due to the interviewee's educational level, role in the organisation and personal interest in sustainability.

Theme 2. Organisations' progress towards the Net zero goals set up by the NYCC

Further analysis suggested how the organisations are progressing towards the Net Zero carbon goals. The analysis explored the areas of Net Zero goals of the NYCC including the organisation's progress towards improving energy efficiency, decarbonising heat and energy supply, green logistics, waste reduction and recycling, circular economy and life cycle analysis. This was compared with the Net Zero Route map set up by the NYCC (York and North Yorkshire LEP, 2021) to have a general understanding of the progress. Also, this progress was compared with the size and the sector of the organisation to provide a general insight into the analysis as shown in ***Table 3***.

This table depicts strategies/practices that the 18 interviewed companies have taken to move towards NYCC's Net Zero goals. It shows eight practices that can contribute to these goals (practices 1 to 8 in columns) and compares them with the participants implementation or progression towards these goals. The companies are compared based on their size and sectors to understand if these have any impact on the implementation of these strategies.

The findings highlighted that most organisations regardless of their size or sector have either implemented or are working towards the implementation of LED lighting and placed waste management measures to improve the energy and resource efficiency. When it comes to implementing measures to improve heat and power supply, including biomass boilers and heat pumps, the findings suggest that almost all large medium sized organisations interviewed have either implemented it or are moving towards it. In terms of installation of solar panels, only three organisations regardless of their size or sector have implemented solar panels in their premises (one large, one medium and one micro company).

In terms of organisations moving towards reducing the use of fossil fuels for transportation, five companies explained their progression towards Electric Vehicles (EV). This was either through efforts to buy EV or implementing EV charging facilities in the organisational premises. However, these organisations are mainly large or medium sized and only except for a micro company. Finally, the findings showed that there is a limited understanding and implementation towards circular economy (CE) concepts in organisations.

Table 3: *Comparative view of organisations progression towards Net Zero goals*

Theme 2. Organisations' progress towards the Net zero goals set up by the NYCC

Company	SECTOR	Nº Employees	Size	Practices to Move Towards Net Zero Goals							
				1-Life Cycle Assessment	2- Waste Reduction	3-Circular Economy	4- Heat & Power	5-Biomass Boiler	6- LED	7- Electric Vehicles	8- Solar Energy
Retail 1	Visitor Economy / Hospitality/Retail	100	Medium		✓				✓		
Retail 2	Food Production	1400	Large	✓	✓			✓	✓		
Retail 3	Visitor Economy / Hospitality	10	Small								
Museum	Visitor Economy / Hospitality/Museum	5	Micro		✓				✓		
Advanced Manufacturing	Manufacturing/Advanced manufacturing	135	Medium		✓						
Engineering 1	Manufacturing/Engineering	1500	Large	✓	✓		✓		✓	✓	
Engineering 2	Manufacturing/Engineering	140	Medium		✓		✓		✓		
Energy	Manufacturing/Energy	2000	Large	✓	✓				✓		
Accomodation 1	Visitor Economy / Hospitality/Hotel	135	Medium		✓		✓	✓	✓	✓	✓
Accomodation 2	Visitor Economy / Hospitality	654	Large				✓		✓	✓	✓
Estate 1	Visitor Economy / Hospitality and Agriculture	200	Medium		✓		✓	✓		✓	
Estate 2	Visitor Economy / Hospitality	40	Small		✓				✓		
Theatre	Visitor Economy / Hospitality	164	Medium		✓						
Media	Digital and creative industries	5	Micro		✓				✓	✓	✓
Cinema	Digital and creative industries/Cinema	18	Small		✓				✓		
Farming 1	agriculture/ rental	4	Micro		✓						
Farming 2	Agriculture/Farming	3	Micro		✓				✓		
Farming 3	Agriculture/Farming	1	Micro						✓		

The organisation's progress towards each of the NYCC's goals will be discussed in detail below.

Decarbonise heat and power supply

The theme on decarbonising heat and power supply showed that most organisations are interested in taking action toward decarbonising heat and power supply. The organisations explained their strategy by considering alternative low carbon fuels, using green energy contracts, product development using biomaterials and using solar panels.

"so we we've got obviously big roofs, just theatre auditoriums are big spaces. And we have investigated the use of solar panels". (Theatre)

However, this organisation explains the barriers they face for the implementation of these strategies have prevented them from moving forward with them.

"but [...] there are two major barriers to this. One is the Council's planning department which is very against solar panels in roofs that affect the view of the heritage of the city, particularly

those buildings which can be viewed from X [information removed to protect anonymity]. And secondly, there is a challenge around the structure of the building and the age of the building in terms of the volume of roof reinforcement that would be required and the challenges around both cost in that but also in terms of embodied carbon in terms of those changes, and actually how much benefit would be gained against it. So, we have investigated that and it's something we remain interested in. But for the moment, it's not something we're progressing.'" (Theatre)

Theatre explains two barriers in relation to heritage buildings where they operate. The first one is related to policies and regulations imposed by local councils and the second one is related to the infrastructure of the building. The organisations explained the age of the buildings can be obstructive when implementing new sustainable technologies, such as solar panels, heat pumps and double glazing. Similar observations are made by the organisations that showed enthusiasm to follow decarbonisation measures. As mentioned by Theatre some policies of the local councils may be conflicting with the implementation of sustainability measures promoted by the government. This is negatively perceived by the organisations as Media states when asked about the barriers encountered in moving towards Net Zero:

"Heritage (emphasises). The fact that you're not allowed double glazing in a Grade 2 listed building which is crazy, you know, that's a massive barrier, those people at X [information removed to protect anonymity], they rate heritage over environment." (Media).

The findings indicate that in order for the NYCC to achieve its goal of increased installation of rooftop solar on business premises by 2034, there needs to be better consideration for more integrated policies, particularly in terms of retrofitting.

Energy and resource efficiency

The theme of energy and resource efficiency evaluated the organisation's progression towards switching to low carbon energy options including LED lighting. Most of the organisations explained moving towards implementing LED lights in their business premises. As Retail 1 from the visitor economy notes:

"We have started replacing lights, we do have a huge amount of lights here. We've started sort of doing it section by section, replacing them. At the moment we've got the 5-foot fluorescence strip lightings in our warehouse. But off the top of my head, there'll be maybe 2 or 3,000 of them just for illuminating the warehouse. So, we have some quotations to change some to LED." (Retail 1)

Similar positive responses from organisations suggested they realise the scope for the LED lighting options and move towards them thus supporting the energy reduction in the economy. The findings indicated the organisations integrate this into their *'existing or upcoming refurbishment work'* or 'u*pgrading programmes' thus* integrating the energy and resource efficiency in their sustainability strategy.

Additionally, the participants recognised more opportunities in their organisation in terms of energy consumption. This included improving the behaviour of the customers and staff to support energy and resource efficiency. For instance, Engineering 2 mentions encouraging the staff towards positive work practices.

"And we're, you know, we're encouraging staff to turn off equipment at the end of day before they leave, and not leaving everything switched on." (Engineering 2).

As the above evidence suggests organisations across the sector express awareness towards energy efficiency and show attempts to improve energy efficiency through the behaviour of their employees and customers. However, there exist challenges when these self-initiative attempts towards energy and resource efficiency. One of the main challenges recognised involves investment and cost associated with moving towards energy efficient technologies in operations. For instance, Retail 1 explains,

"The biggest issue that we come across is the outlay of capital. So if we have (round figures) 2,000 fluorescent light strips in our warehouse, and each one of those was to be replaced by a low energy alternative, you're looking at tens of thousands of pounds in the initial outlay." (Retail 1)

Retail 1 explains that the main barrier for moving towards LED lights is the investment required to implement them. Similarly, the majority of the participants explain their concern regarding cost implied despite their interest to move toward energy initiatives. However, further barriers were recognised according to the sectoral categories as shown in ***Table 4***.

Table 4: Examples of additional barriers to transition to Net Zero per sector

Sectors	Barriers
Visitor economy	Restrictions due to the heritage locations
Agriculture, manufacturing, food production, visitor economy	Rural location, far from urban centres and facilities
Energy, agriculture	Lack of information related to low carbon energy initiatives in the sector
Agriculture, property management	Restrictions from landlords
Property management, visitor economy	Lack of time to invest in the low carbon initiatives

The table shows some of the barriers expressed by different sectors in terms of moving towards implementing more energy-efficient methods in their organisations (beyond cost and capital investment). Therefore, to achieve the Net Zero goals set out by the NYCC, the

government may need to allocate additional resources with better understanding of the sectoral requirements.

Reduce the use of fossil fuels and moving toward electricity

This research found that organisations are very much reliant on fossil fuels for their daily operations. The reason for this reliance on fossil fuels is mainly due to the nature of the business operations, underdeveloped technology (for example low autonomy of electric vehicles), the investment required for electric vehicles and the lack of infrastructure for using electric vehicles (for example lack of charging points).

Some of the below interview extracts highlight these issues (when asked about their reliance on the use of fossil fuels in their day to day operations).

"We use X [anonymised] when we supply products in the UK, we use a courier when we supply products outside the UK, it's the freight agent we would use. Couriers, not all couriers will accept hazardous goods. So even if one, one courier would switch to electric vehicles and we wanted to go with them, we couldn't necessarily just change everything, because we are shipping hazardous products and that kind of estranges in all sorts of ways. Really." (Engineering 2)

"So I don't.. we do operate some vehicles ourselves directly. And then other than that, we're dependent on third parties obviously, shipping companies. Third party logistics and all yes. And the extent to which they've transitioned from fossil fuels is probably fairly limited at this moment in time. So I think we're dependent quite heavily on fossil fuels just at the moment on logistics." (Retail 2)

"Quite a lot, because of all the work we do. We use tractors and what have you so again, you know, that diesel-powered so yeah, I would say.. you know, yeah, you have your tractors to sort of do nearly everything you need to when you run your business. Yeah." (Farming 2)

As the above interview extract shows, participants from the agricultural sector also point out the limitation of battery power which can hinder the move towards electric vehicles. Thus, the findings highlight a general limitation for organisations to move toward green logistics due to technological restrictions. Similarly, the costs associated with investing in electric vehicles were found to be another concern in this study.

As the above evidence shows organisations from different sectors are reliant on the supply chain of third parties explaining they are having limited options when selecting green logistics. Similarly, the participants from the agricultural sector and visitor economy explain how the lack of technological advancement and their rural location are also limiting the prospect of using electric tractors or electric minivans for their business requirements.

Theatre engages in the conversation as follows.

“potentially, I think we're waiting for the technology to get to where it needs to be to facilitate that. You know, we have a transit van that we use that is relatively battered and bruised. And we've looked.. when we renew the van we will look at an electric vehicle as a solution. Obviously that is contingent upon the payload size that the battery will allow for and the range of the vehicle. So you know if we need a trip to London, can it take 500 kilos of stuff down to London in a single journey, etc, etc. I think as an industry it requires the big vehicles, the trucks and lorries and HGVs to have the capacity to be electric before that change can be made.” (Theatre).

While some organisations explained their interest to move towards car-pooling and cycling, the main barrier they recognised was the nature of the organisation's operations where employee shifts may vary. For instance, participant from Cinema explains,

*“.. they did try to implement a bike to work scheme before lockdown. it didn't really work so much because a lot of people did already drive or have lived slightly too far out for public transport for biking and stuff, and especially our hours. People don't want to be biking at those pitch black in the middle of winter. Well, I don't really want to be cycling down, public roads and stuff. So, there is that kind of boundary as well.” (*Cinema*)*

The above interview extract from Cinema summarises the major obstacle when organisations strive to achieve greener logistical operations, such as cycling or car pooling. The findings showed that while organisations try to introduce schemes the rural location, lack of infrastructure and the nature of the work might prevent the employees from moving towards greener logistics. This implies that the government needs to invest in research and development towards green logistics while also informing the options available for the organisations when moving towards the same. Moreover, providing funding opportunities for sectors to move towards greener logistics and informing them of such opportunities can support the government's move towards Net Zero strategies.

Circular economy

The findings in this research show that, even though companies in general do not know enough about the concept of circular economy as such, in practice most of the organisations try to incorporate recycling, reusing and repurposing activities, the scope of which is dependent on the sectors. Participants across the sectors explained the opportunities for waste reduction depending on the waste produced in their sector. The food and packaging waste were found to be major waste relevant across the visitor economy, importers and distributors, manufacturing, digital and creative industry, food production, energy production and agricultural industry.

For example, the below extract shows how organisations manage their waste,

"If there's any building works, we recycle our own woods. So, if we need to make posts and rails and then we use our own woods, so we recycle that. That's probably about it. Really. Yeah. And then yeah, and then you have just the virtual circle of farmyard manure. So, if you have lives, then you recycle their farmyard manure onto the crops. And then ultimately the crops will go into the feed production." (Farming 1)

"Food waste is a primary one in terms of our short shelf life of products in F's and how can we make sure that we forecast as accurately as possible over a short period because obviously, you can have all sorts of influencing factors like the weather that will affect demand in our cafe and therefore leave you with potential for surplus product and then how do we avoid waste by ensuring it's like donated into supply chains, into community groups or we can reuse that product in different ways." (Retail 2)

"So we.. 12 months ago, we didn't split out food waste. So, we now split up food waste, and that goes to an anaerobic respiration. So, it's used for energy generation, rather than waste. And we split out general waste and recycling" (Theatre)

As the above evidence shows, participants explained their initiatives in managing waste depending on the waste produced in each sector. For the agricultural sector, the waste produced in farming is used in a 'virtual circle' as the above extract implies. Unsurprisingly, Retail 2 explained their main waste to be food, however, the participant explained their strategy of forecasting the demand and supply while ensuring the surplus be donated to community groups.

The findings also highlighted how organisations use technology to manage waste. As the above extract from Participant L explains how they use technology to treat waste which is converted to energy thus contributing to the circular economy. Similarly, the manufacturing company in this study explains having invested in technology to capture their carbon waste, which they can store or distribute to different sectors. The findings thus showed the organisations' attempts to recycle, reuse and repurpose the waste indicating a circular economy perspective in their operations.

Thus, the analysis produced encouraging results in terms of the organisations' self-initiative towards incorporating technology and management practices for better waste management. However, there was no mention of government funding or other initiatives available for the organisations towards waste management.

Theme 3: Government support in moving towards Net-Zero

The theme of government support produced two dimensions where organisations raised their concerns over the lack of information shared with the organisations in relation to Net Zero goals committed by the NYCC and the inadequate financial support measures.

Lack of information

Most of the organisations in the study explained the lack of governmental support in terms of general information being provided to the company on the Net Zero goals. For instance, when asked about their awareness of the NYCC region's aim to become the first Net Zero carbon region in England, the answers mostly reflected a lack of knowledge. Some of the interview extracts are given below:

"*No, I didn't know that*." (Advanced Manufacturing)

"I didn't know it was the first region in England" (Museum)

The findings thus highlighted the lack of information received by the organisations about the NYCC's Net Zero strategy and the role of organisations in achieving this goal. The lack of awareness was in terms of the NYCC's aim to become the first carbon-negative region, their specific targets in achieving this goal and the role that organisations are expected to play for the achievement of the Net Zero objectives. Despite this, there was some general understanding among the participants of the significance of Net Zero initiatives and the organisations' role in achieving it. However, the interviewees further implied their frustration with the lack of guidelines to move toward this Net Zero goal. For instance, Advanced Manufacturing continued to explain how they are not provided with the required information on moving forward to achieve this climate change goal.

"Just there isn't. It feels to me, if there's just… really isn't anything. So yeah, I just think that support in understanding what could be done and how to go about it. You know, I know that I understand that every single business is different. But there will be common themes, you know, who's doing what, what's working well, and who's tried other things that didn't work so well. You know, Are there lots of quick wins that have made a significant difference?" (Advanced Manufacturing)

Adding to the theme of *confusion,* Engineering 1 explained that they feel this is like a *puzzle* which needs to be solved and will not be solved in 2034 if clear information is not provided. According to them,

"I'm quite educated on it, because I've been doing it for a while, but I didn't know that North Yorkshire has targets. so I think maybe some public awareness of these targets and what that actually means to your business, carbon neutral by 2034 that's significant… that's 12 years, it's nothing really and how they can assist you to get to that and what that means for you as a business, and how you slot in that puzzle piece, because they.. they won't get 2034 at the time this is onboard." (Engineering 1)

The interviewee was the sustainability manager Engineering 1 and was quite informed about the implications of sustainability. The company was also quite proactive in terms of sustainability strategy. However, it becomes more frustrating for them when the government initiatives like this fail to reach them. As the above interview extract shows, the participants insisted on the requirement for achievable guidelines be provided for the organisations

across sectors to achieve the target by 2034. Moreover, the findings suggest that the awareness should not be limited to the organisations, but there need to be initiatives to raise public awareness, so the organisations can work with their stakeholders towards achieving the Net Zero goals via achievable targets along the way.

Lack of funding support

The findings indicate that there was a lack of financial support for the organisations to move towards Net Zero. As mentioned earlier, the investment and cost associated when implementing Net Zero strategies may become a significant barrier for organisations. While the organisations expressed their interest to move toward an approach to support the Net Zero strategies provided they get the information, the findings indicate the lack of funding may continue to block the progress. However, there was a strong implication that adequate funding can encourage organisations to move towards Net Zero goals across sectors.

"So there also needs to be some investment in being able to send power to the grid and then buy it back at either at a reduced rate or get money for the power sent to the grid. So, I think this infrastructure piece is needed there. But yeah, we would absolutely benefit from investment." (Theatre)

"so I think with most farmers, if the reward is there and it's fair with the reward or the payments." (Farming 2)

Summary of interviews results

As the evidence shows in addition to information and infrastructure, funding seems to be a strong enabler for an organisation to move towards Net Zero strategies. Most of the organisations explained lacking funding to replace LED lights, solar panels or move towards other energy-efficient technologies. However, there was also a reference towards funding in research and development to improve green technology and for employee training for the workforce who are more skilled in greener technologies. Thus, the findings showed that the funding opportunities can *massively* improve the organisation's approach toward Net Zero strategies. As Farming 2 in the agricultural sector addresses it as a '*reward'* that the farmers will embrace when moving towards Net Zero strategies.

3.2 Survey

The survey questionnaire was built and distributed using Qualtrics. The questionnaire was sent by email to a random sample of 2,187 respondents involving Executive Directors, Chief Financial and Operational Officers, and Senior Managers companies registered across all district councils of North Yorkshire.[1]

[1] For a 95 percent level of confidence, and a margin of error of 5 percent, we calculated that the sample size would be at least 200 to represent our target population.

Data collection activities included initial and follow-up mailings of the survey questionnaire. The survey response rate was extremely low, at about 1 percent. There were only 28 replies in total, including 6 that were not happy to proceed to the questionnaire, and 2 that did not complete the survey. After discarding nonresponses and incomplete answers, only 20 responses contained complete information and were used in the analysis using MS Excel. Therefore, the results should be treated with caution, and used as indicative rather than reliable differences. The percentages refer to percentage of respondents and for some questions, the results were normalised due to the respondents being asked to choose multiple alternatives.

The profile of the companies/respondents included in the sample is shown in ***Table 5.***

Table 5*: Sample characteristics*

Company Size	**%**
Micro (1-9 employees)	31
SME (10-249 employees)	54
Large (>=250 employees)	15
District	**%**
Scarborough	23
Harrogate	23
Hambleton	15
York	8
Selby	8
Ryedale	8
Richmondshire	8
Craven	8
Sector	**%**
Manufacturing	23
Education	15
IT, digital and creative	15
Travel and leisure	15
Health	8
Service industries	8
Transport and distribution	8
Other	8
Job title	**%**
President	23
Administrative	23
Management	15
Other	15
Executive Director	8
Chief Financial	8
Operational Manager	8

To understand what guides the behaviour of the companies in North Yorkshire, the survey listed several potential priorities, and asked them to select the three most important to them. The most important priority for businesses was chosen as: reducing costs, reduce lead time, and improve service levels. Next, at the same level of importance: protecting the environment, hiring employees, increasing profits, health and safety practices as well as equality and diversity inclusion policies. Finally, in third place of importance: expanding business and supporting community. These results show that mainly the companies are concerned about economic issues, then social issues and finally environmental issues. See ***Figure 3.***

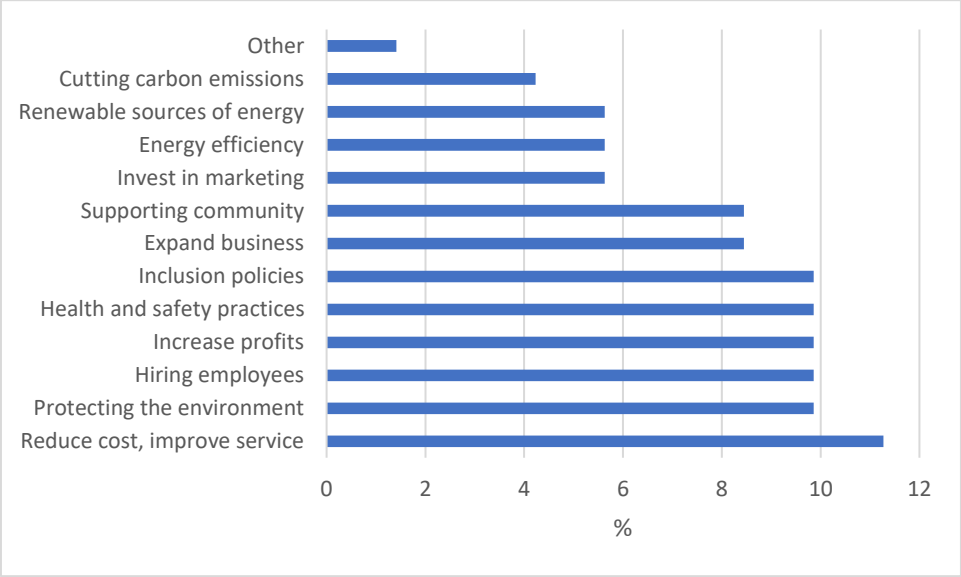

Figure 3*: Business priorities*

Table 6 shows the obstacles to current operations and growth for businesses. The main obstacles were reported as (1) taxes and regulations and (2) cost of energy, followed by (3) Brexit, (4) political instability and (5) inadequate infrastructure for sustainable transport.

Table 6: *Obstacles to current operations and growth*

Obstacles	%
Taxes and regulations	14
Costs of energy	14
Brexit	13
Political instability	12
Inadequate infrastructure for sustainable transport	12
Access to finance	10
Inadequate educated workforce	10
Labour regulations	7
Climate change	7

Companies were also asked what the major impacts of climate change and extreme weather events on their business in the last two years (see ***Table 7***) have been. The main impacts mentioned were: (1) disruptions in supply chains, (2) increase in insurance costs, (3) damage to property and equipment, and (4) increase in regulations and laws.

Table 7: *Impacts of climate change on businesses*

Impacts of climate change	**%**
Disruptions in supply chains	21
Increase in insurance costs	21
Damage to property and equipment	21
Increase in regulations and laws	16
Other	11
Changes in consumer trends	5
Decline in labour productivity	5

From the sample, 38% companies declared that they have measured their CO_2 emissions in the last two years. From these, the estimated emissions are shown in ***Table 8.***

Table 8: *CO_2 emissions estimation as per last year*

CO_2 emissions/year	**%**
Below 12,500 tonnes	50
Other number	25
12,500 - 25,000 tonnes	13
25,000 - 50,000 tonnes	13
50,000 - 125,000 tonnes	0
125,000 - 1,000,000 tonnes	0
Over 1,000,000 tonnes	0

Many businesses adopted measures to reduce their environmental impact. Four top motivations were identified for them to do this: (1) build, maintain or improve business reputation; (2) align with company's goals, mission, and values; (3) make a positive impact on an issue; (4) attract, motivate and retain employees. See ***Figure 4***.

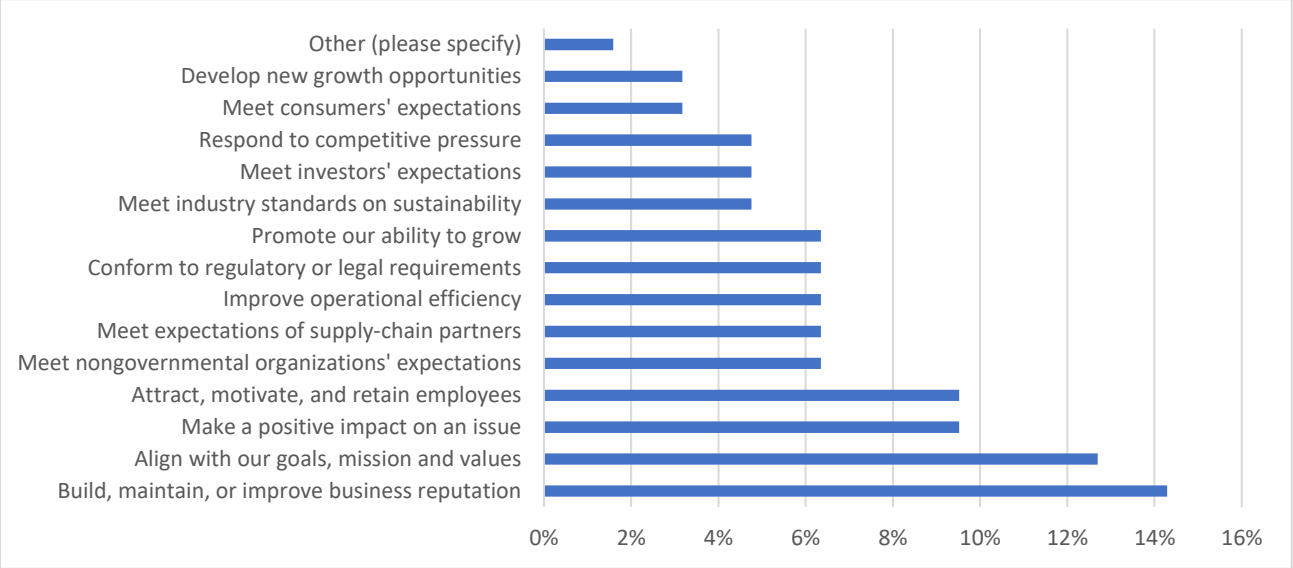

Figure 4: *Motivations for adopting measures to reduce environmental impact*

However, there were some challenges that prevented businesses from adopting measures to reduce their environmental impact. Three main challenges were identified: (1) not opportunity presented; (2) lack of financial resources; (3) operational and/or technical risks. See ***Figure 5***.

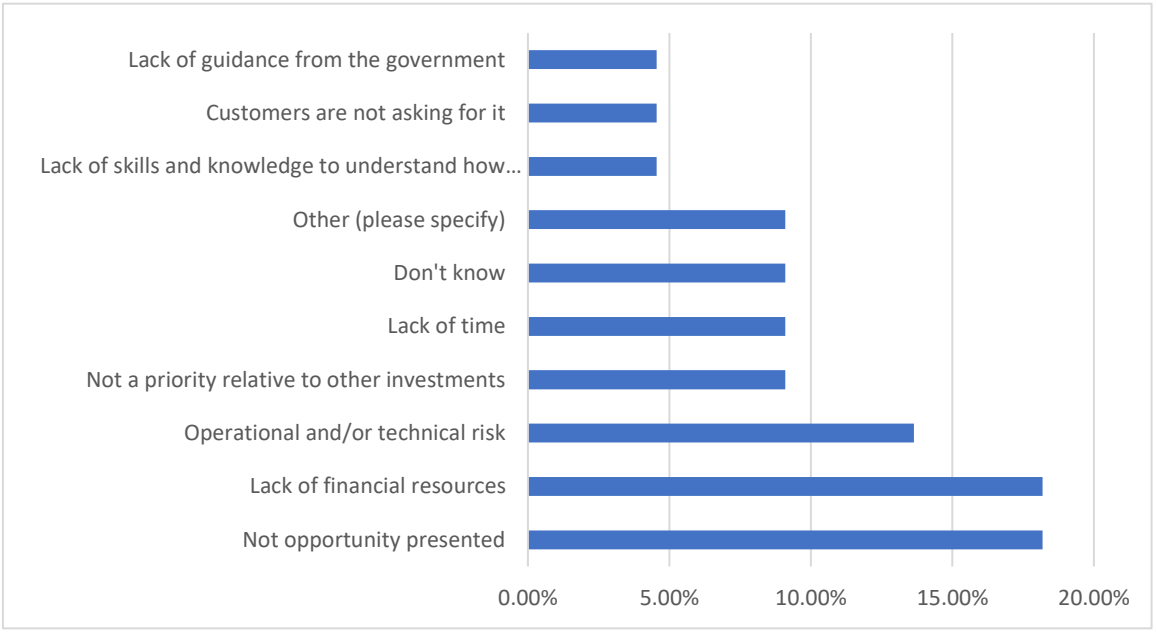

Figure 5*: Challenges in adopting measures to reduce environmental impact*

The measures taken by businesses, in the last two years, to reduce their environmental impact included: (1) waste minimisation, (2) energy management, (3) lighting systems and (4) upgrades of vehicles. See ***Figure 6***.

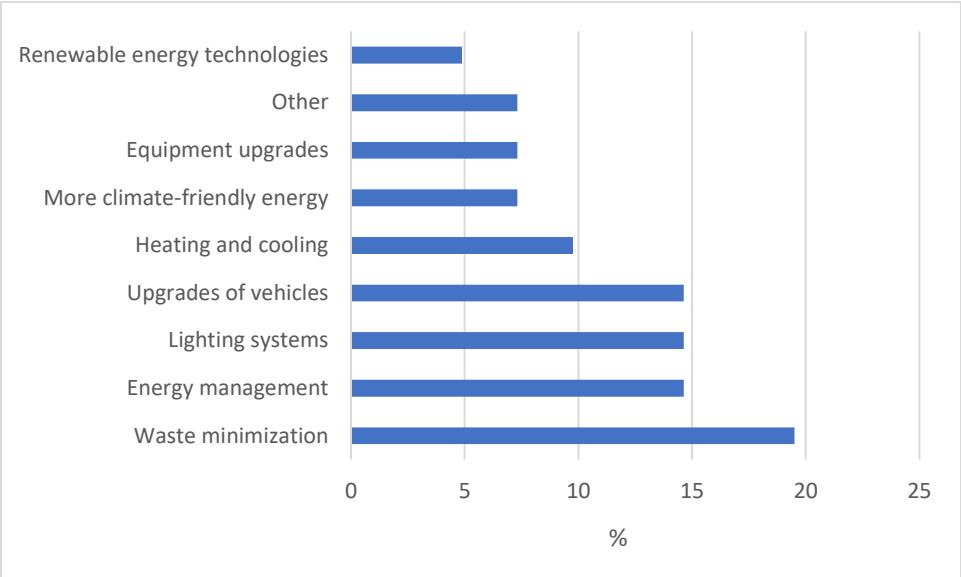

Figure 6: *Measures to reduce environmental impact*

The types of support that companies would value the most from the government in the fight to climate change include: (1) more investment in green technology, (2) more incentives for eco-friendly products, (3) more infrastructure, (4) financial support, and (5) local sustainability programmes. See ***Table 9***.

Table 9: *Business expectations about government support*

Government support for businesses to fight climate change	**%**
More investment in green technology	23
Incentives for eco-friendly products (tax incentives, purchasing expansion of public agencies, etc.)	13
More infrastructure building for joint facilities or green partnerships	13
Financial support	10
More local sustainability programmes	10
Less complex and onerous tendering process	6
Certainty around renewable energy incentives	6
Information about how to get to Net Zero goals	6
Other (please specify)	6
More emissions trading schemes	3
Dissemination of new technology information	3

Most of the companies believe that the priorities of the local government are concerned about: (1) ensuring business survival, (2) promoting maximum employment, (3) maintain roads and good infrastructure, whereas a minority believed that it was concerned about (4)

reducing poverty and economic inequality, (5) fighting climate change/global warming and (5) achieving Net Zero goals. See ***Figure 7***.

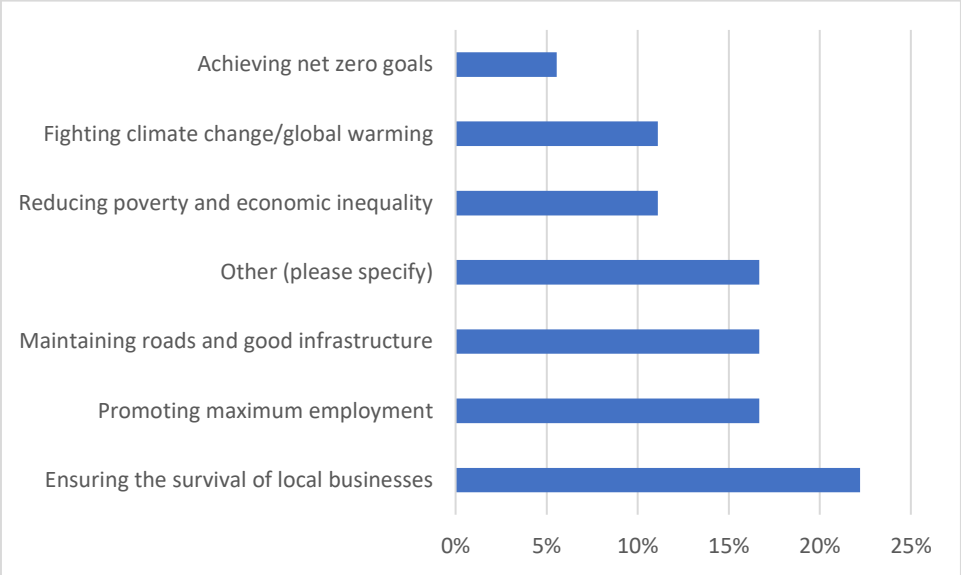

Figure 7: *Business perceptions about local government priorities*

According to the Department for Business, Energy and Industrial Strategy (BEIS), funding is available to help UK businesses to reach Net Zero emissions by 2050. Businesses were asked if they were aware about the support and funding opportunities, which were listed as given below.

- Renewable Energy Technologies Fund
- Skills Support for the Workforce
- Business Scale Up
- York Go-Greener Fund
- Investment Fund
- Big Issue Event
- Key Fund
- Better Business Finance

Unfortunately, it was found that no business had taken advantage of the above funding opportunities and most were unaware of them.

From the respondents, 50% believed that the local government is not doing enough to help businesses in North Yorkshire to reduce their carbon dioxide emissions with the other 50% stating that they did not know.

Summary of survey results

- Reducing costs, reduce lead time, and improve service levels constitute the most important priority for businesses in North Yorkshire.

- Obstacles to their current operations and growth include taxes and regulations, cost of energy and Brexit.
- The major impacts of climate change and extreme weather events on businesses in the last two years included disruption in supply chains, increase in insurance costs, and damage to property and equipment.
- The more popular measures the company adopted to reducing the company's environmental impact over the last two years were: waste minimization, energy management, lighting system, and upgrade of vehicles.
- The most cited reason for adopting measures for reducing the company's environmental impact was to build, maintain, or improve business reputation.
- The reasons for not adopting measures for reducing the company's environmental impact included: lack of financial resources, operational risk and not opportunity presented.
- Types of support the company would value more from the local government to fight against climate change included: more investment in green technology, more incentives for eco-friendly products, more infrastructure, financial support, and local sustainability programmes.

3.3 Workshop: Dissemination of Preliminary results

In order to disseminate the preliminary results of this project, a hybrid workshop was organised on 15th September 2022, which was hosted by the University of York and sponsored by the British Academy of Management Performance Management SIG, as well as the North Yorkshire County Council and Higher Education Innovation Fund. See ***Appendix C*** for the booklet including the Programme for the event.

There were three main keynote speakers: Prof. Steve Evans (University of Cambridge), Prof. Sonal Choudhary (University of York) and Prof. Melanie Kreye (University of York). Two workshops were run in parallel. Workshop 1 was run by Dr Luisa Huatuco on behalf of the research team to present this project's preliminary results, whereas Workshop 2 was run by Dr Vinh Chau (University of Kent) on the Paradox of Conservation and Control.

The event was attended by 35 delegates from Universities, practitioners and policy makers. There were fruitful discussions during the day and positive feedback comments have been received from attendees. See ***Appendix D*** for the list of attendees.

The workshop was designed first to share the preliminary results of the interviews and survey responses on this research project, then to work in small groups to address the following questions:

Q1: How can the Government increase awareness of Net Zero targets among businesses?

Q2: How can the Government provide the infrastructure for businesses to achieve Net Zero?

Q3: How can the Government help businesses with financial support to achieve Net Zero?

Q4: What further legislation is needed for businesses to achieve Net Zero?

After introductions and sharing of initial ideas, each group was asked to address one question and to write down (either on flip chart paper or on Padlet if attending online) their key thoughts of their individual group discussion. They were asked to imagine the strategies in 5, 10 and 30 years from now, and they could choose a particular sector of the Economy, if they preferred. Then, they were asked to select a speaker for the group who presented their summary to the whole workshop.

The results are shown below:

Workshop Results:

Q1: How can the Government increase awareness of Net Zero targets among businesses?

- Show the benefits
- It is feasible/possible to achieve Net Zero
- Encourage large companies to show their current efforts for carbon reduction
- Run awareness campaigns - now
- Involve all stakeholders -now
- Think of end users as well - now
- Change in culture: 5 years
- Spill over effects: 10 years

Q2: How can the Government provide the infrastructure for businesses to achieve Net Zero?

- 5 years: Decarbonising energy system
- Hydrogen carbon capture - Gamble + risk, balance and amount of change
- Government investment (greater) private sector
- Informing businesses and public what options are
- investing in logistics or transport infrastructure
- UK Net Zero College online
- Digital infrastructure (hardware + software), Big Data, AI
- decarbonising energy: 10 years
- coordinating hydrogen infrastructure (pipelines, manufacturing fuel cells)
- Incentive/disincentive schemes for Net Zero, congestion charge
- Gamification of data - food miles Net Zero for tourists
- Building tracing mechanisms for collaboration - Information sharing infrastructure
- Trusted convening, e.g. Advanced Manufacturing Research Centre - AMRC (big firms)
- Infrastructure for an energy-intensive company is very expensive
- Make it economically viable
- Create culture of sharing infrastructure

Q3: How can the Government help businesses with financial support to achieve Net Zero?

- Loans for long term investments (energy efficiency): 5 years
- Investment in training and skills for sustainable specific transformation: 5 years
- R&D (more tax rebates, direct incentives): 10 years
- Incentives to build local smart energy grids: 10+ years
- Transport/infrastructure (drive people out of cars): 30 years

Q4: What further legislation is needed for businesses to achieve Net Zero?

- Building awareness in the public. Create culture first on every stakeholder then build the legislation to facilitate the path.
- Incentives for companies to reduce their energy consumption
- Incentives to reduce the fertilisers usage
- Ideally this needs to be Business Driven and supported by the Government. I guess [anonymised]'s point on Materiality would also be a Key here; As most of the SMEs are focusing on short-term profitability, it would be imperative for them to understand the business case for moving towards Net Zero, e.g. Cost associated with not reporting their emissions.

Figure 8 shows the map of bringing the results together from interviews and survey via the workshop.

Figure 8: *Mapping results towards recommendations*

4. Conclusions and recommendations

To conclude this research used both qualitative and quantitative methods to evaluate the current progress by businesses in North Yorkshire towards the Net Zero goals and the progress of different sectors towards the same. The methodologies used in this research complemented one another, i.e. the interviews provided in-depth understanding of key issues and the survey questionnaire was intended to reach out a wider proportion of the businesses in the region.

The findings in this research showed the significant challenges ahead for the NYCC to reach its Net-Zero goals of becoming carbon neutral by 2034 and carbon negative by 2040.

However, on a positive note, organisations are proactive in their approach towards sustainability, evident from their self-initiative to work towards decarbonisation. There is a good scope for organisations to achieve the goals provided they are given the right information and funding support.

While this research throws some insights into the current prospect of the NYCC regions Net-zero carbon strategy this is not without its limitations. Mainly the limitations of access to respondents proved challenging. So, with the caveat of the response rate to the survey questionnaire being extremely low, it is still possible to draw some meaningful insights from this research.

The following recommendations are drawn from the findings of the study and the conclusions drawn from them. These are thematically grouped and presented below.

-Increase the level of awareness and provide some more guidance to reach Net Zero

- Improve the awareness of companies by designing measures to share good practices and provide sectoral advice, i.e. to identify good practices towards attaining Net-Zero goals based on sectoral analysis and disseminate them to organisations.
- The government can develop plans to work in partnership with large organisations as sector leaders, which have successful Net Zero carbon strategies implemented where they can share their experiences to the organisations in their sector.
- Set up a specific “Net Zero Goal Office”, where companies can get in touch to make related enquiries, e.g. general information, technical advice, funding, etc.

- Promote further research to understand the sectoral progress to achieve Net Zero

- There needs to be a better understanding of the sectors depending on their nature, the challenges they face and the opportunities available for the sectors.
- There seems to be some confusion among businesses on what can be done and not done especially in terms of ‘*heritage’* buildings.
- Policies need to be designed to be clearly communicated to the sectors, further research should be carried out on each sector to understand:

✓ The enablers/barriers organisations face when implementing their Net Zero strategy.
✓ The opportunities/challenges they face to effectively implement their Net-Zero strategy.

- Provide further government financial support and motivation towards Net-zero strategy

- Develop funding opportunities to help organisations moving towards Net-Zero strategy.
- Design and develop attractive incentives for organisations which attain each level of Net-Zero goals.
- Time seems to be another constraint for the organisations to focus on the Net zero strategies. Therefore, specific support groups, which can include Communities of Practices and expert panels should be organised to provide Net Zero assessment for organisations in each sector.

Acknowledgements

The authors wish to gratefully acknowledge the funding received for carrying out this project, our thanks to the North Yorkshire County Council and the Higher Education Innovation Fund at the University of York (Grant number: H0029053). Also, we would like to thank the NYCC representatives for their support/feedback during the project. We extend our appreciation to the managers of the participating organisations in North Yorkshire who provided their valuable time during the data collection for this project. Many thanks to our colleagues at the Research, Innovation and Knowledge Exchange for their facilitation of the project and to our School for Business and Society colleague who acted as the internal reviewer of the draft of this report.

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Appendices

Appendix A*:* Questionnaire used in the semi-structured interviews

Strategies towards achieving low carbon and high-value added from the economic sectors in North Yorkshire
QUESTIONNAIRE

A) <u>General Aspects:</u>

1. Are you aware of the North Yorkshire region's aim to become the first carbon negative region in England? aim to achieve net zero by 2034?
2. What does achieving net zero mean to your organisation?
3. Do you see scope for adopting better working practices that increase productivity and sustainability?
4. Are you aware of the environmental impact that your organisation generates as part of its normal operations?
5. How is your sector influenced by these initiatives of low carbon and high value added?

<u>B) Improve energy and resource efficiency</u>

1. Do you think there are opportunities in your sector to reduce energy bills? How?
2. Has your organisation evaluated switching to low carbon technologies, such as LED lighting?
3. How do you manage the energy costs associated with your organisations' operations?
4. What opportunities and barriers does your organisation face in relation to sustainable energy use in your sector?
5. Are there any processes in your organisation where you see opportunities for waste reduction?

<u>C) Decarbonise heat and power supply</u>

1. What does achieving low carbon mean to your organisation?
2. Are there any initiatives for decarbonisation (e.g. use of renewables) that your organisation is currently involved in?
3. Have you evaluated switching to low carbon heating options and green tariffs?
4. Have you explored options to generate energy on site? (such as Solar PV, heat pumps for off-gas-grid properties)
5. What opportunities and barriers are there for sustainable heating and power supply in your sector?

<u>D) Develop cleaner logistics</u>

1. To what extent is your organisation's transportation and business operations dependent on fossil fuels?

2. Can you think of options in your organisation to reduce transport usage and fuel costs?
3. What alternative transportation means would your organisation consider to reduce its carbon emissions?
4. Is it possible for your organisation to use electric vehicles and similar technologies?
5. What opportunities and barriers do you see for developing green logistics in your sector?

E) Move towards circular business models & sustainable supply chains

1. What does circular economy mean to your organisation?
2. Do you see scope for a more "circular economy" business model in your organisation's activity?
3. Has your organisation considered doing a Life Cycle Analysis of its main products/services?
4. To what extent does your organisation reuse, recycle, upcycle, repurpose?
5. What advantages and disadvantages can you see from your sector taking a circular economy perspective?

F) Public funding support from National and Local Government

1. To what extent would your organisation benefit from having public investment in achieving Net Zero strategies?
2. Have you received financial or other types of support from the public sector to address the challenge of achieving Net Zero? how?
3. Do you perceive that the current level of support provided by the Government is adequate?
4. What specific (additional) support measures from the local government would your organisation consider relevant?
5. What else should the local government do for organisations in your sector with regards to achieving Net Zero?

Keywords: Net Zero, high value added, clusters

Note: The interview should last 45 mins max. For each interview, there must be a time allocated to contacting the company, setting up the interview, doing the interview, and processing the results. Interviews will be recorded. Ideally, they will be done on Zoom, in some cases face-to-face interviews could take place.

Appendix B: *Questionnaire used in the survey*

Online Questionnaire

MODULE 1. Respondent's characteristics (2 Questions)
MODULE 2. Firm's characteristics (4 Questions)
MODULE 3. Business environment (4 Questions)
MODULE 4. Environmental practices (7 Questions)
MODULE 5. Local government (5 Questions)
MODULE 6. Feedback (1 Question)

Email invite

Dear Business Community

Researchers at the University of York in collaboration with the North Yorkshire County Council are carrying out a study on **strategies and actions taken by local businesses around sustainability in North Yorkshire**.

We would be extremely grateful if you help us to find out more about the challenges that your organisation is facing in relation to achieving sustainability in our region.

The survey will take **no longer than 15 minutes**

The survey is here:
${l://SurveyLink?d=Take the Survey}
Or copy and paste the URL below into your internet browser:
${l://SurveyURL}

Thank you in advance for your participation and support.
Sincerely yours
Graciela

PS: The survey will be open until 31st August 2022.

Follow the link to opt out of future emails:
${l://OptOutLink?d=Click here to unsubscribe}

Introduction

Thank you for taking the time to participate in this survey. The survey should take no longer than 15 minutes to complete and the information gathered here will help us to recommend interventions that support business like yours to move towards net zero goals.

Your participation in this study is strictly voluntary. Your responses will be kept anonymous. Neither your name nor the name of your business will be used in any document based on this survey. If you have questions regarding the survey or use of the results please contact Dr Graciela Zevallos at University of York via graciela.zevallos@york.ac.uk

Are you happy to proceed?

- ○ No, thanks (6)
- ○ Yes, I am happy to continue (7)

MODULE 1. Respondent's characteristics

Position

1. Please indicate which option best describes your current position in the company.

- ○ President (1)
- ○ Executive Director (2)
- ○ Chief Financial (3)
- ○ Chief Operational Officer (4)
- ○ Administrative (5)
- ○ Management (6)
- ○ Operational Manager (7)
- ○ Other (please specify) (8) _____

Display This Question:

If Position = 4

Or Position = 5

Or Position = 6

Or Position = 7

Or Position = 8

Department

2. What department do you work in?

- ○ Accounting (1)
- ○ Administrative (2)
- ○ Business (3)
- ○ Customer service (4)
- ○ Engineering (5)
- ○ Finance (6)
- ○ Human resources (7)
- ○ IT (8)
- ○ International (9)
- ○ Legal (10)
- ○ Manufacturing (11)
- ○ Marketing (12)
- ○ Operations (13)
- ○ Product (14)
- ○ Public relations (15)
- ○ Research and development (16)
- ○ Sales (17)
- ○ Other (please specify) (18)

MODULE 2. Firm's characteristics

Location

3. Which district council area is your company currently based in?

- ○ Craven (1)
- ○ Hambleton (2)
- ○ Harrogate (3)
- ○ Richmondshire (4)
- ○ Ryedale (5)
- ○ Scarborough (6)
- ○ Selby (7)
- ○ York (8)

Years of operation

4. Please indicate the length of time the company has been in operation.

- ○ Not yet trading (1)
- ○ 0–2 years trading (2)
- ○ 3–6 years trading (3)
- ○ 7–10 years trading (4)
- ○ 11–15 years trading (5)
- ○ 16–20 years trading (6)
- ○ 21+ years trading (7)

Sector

5. What is your company's primary sector?

- ○ Agriculture and food (1)
- ○ Business and finance (2)
- ○ Construction (3)
- ○ Education (4)
- ○ Health (5)
- ○ Hospitality and catering (6)
- ○ IT, digital and creative (7)
- ○ Life sciences (8)
- ○ Manufacturing (9)
- ○ Mining (10)
- ○ Real estate and property (11)
- ○ Science and technology (12)
- ○ Service industries (13)
- ○ Transport and distribution (14)
- ○ Travel and leisure (15)
- ○ Utilities providers (16)
- ○ Wholesale and retail (17)
- ○ Other (please specify) (18)

Size

6. Please indicate the range of number of employees for the business.

- ○ No employees (1)
- ○ 1-9 employees (2)
- ○ 10-49 employees (3)
- ○ 50-249 employees (4)
- ○ 250-500 employees (5)
- ○ More than 500 employees (6)

MODULE 3. Business environment

Business priorities

7. Which of the following points does your business prioritise? Please select three.

- [ ] Expand business (1)
- [ ] Invest in marketing (2)
- [ ] Protect the environment (3)
- [ ] Cutting carbon dioxide emissions (4)
- [ ] Hiring employees (5)
- [ ] Increase profits (6)
- [ ] Health and safety practices (7)
- [ ] Supporting the local community (8)
- [ ] Equality and diversity inclusion policies (9)
- [ ] Increase energy efficiency (10)
- [ ] Incorporate renewable sources of energy (11)
- [ ] Reduce cost, reduce lead time, improve service level (12)
- [ ] Other (please specify) (13)

Operations and growth obstacles

8. To what degree are each of the following factors an obstacle to the current operations and growth of the company?

Access to finance	▼ No obstacle (1) ... Don't know (6)
Brexit	▼ No obstacle (1) ... Don't know (6)
Labour regulations	▼ No obstacle (1) ... Don't know (6)
Political instability	▼ No obstacle (1) ... Don't know (6)
Taxes and regulations	▼ No obstacle (1) ... Don't know (6)
Costs of energy	▼ No obstacle (1) ... Don't know (6)
Climate change	▼ No obstacle (1) ... Don't know (6)
Inadequate infrastructure for sustainable transport	▼ No obstacle (1) ... Don't know (6)
Inadequate educated workforce	▼ No obstacle (1) ... Don't know (6)

Net profit expectations

9. How do you anticipate the net profit for your company will change over the next two years? The net profit represents the amount of money your business earns after deducting all operating, interest, and tax expenses.

- ○ Will substantially decrease (1)
- ○ Will slightly decrease (2)
- ○ Will stay the same (3)
- ○ Will slightly increase (4)
- ○ Will substantially increase (5)

Climate change threats

10. What have been the major impacts of climate change and extreme weather events on your business in the last two years? Please select three.

- [ ] Decline in labour productivity (1)
- [ ] Disruptions in supply chains (2)
- [ ] Changes in technologies and consumer trends (3)
- [ ] Increase in insurance costs (4)
- [ ] Increase in regulations and laws (5)
- [ ] Damage to land, property or equipment (6)
- [ ] Loss of agro-biodiversity (7)
- [ ] Other (please specify) (8)

MODULE 4. Environmental practices

Carbon emissions

11. Over the last two years, did your company measure carbon dioxide (CO2) emissions?

- ○ Yes (1)
- ○ No (2)
- ○ Don't know (3)
- ○ Prefer not to say (4)

12. How much carbon dioxide (CO2) emissions did the company released last year, if any? Please include all direct carbon dioxide emissions from activities owned or controlled by your company that release emissions straight into the atmosphere.

- ○ Below 12,500 tonnes (1)
- ○ 12,500 - 25,000 tonnes (2)
- ○ 25,000 - 50,000 tonnes (3)
- ○ 50,000 - 125,000 tonnes (4)
- ○ 125,000 - 1,000,000 tonnes (5)
- ○ Over 1,000,000 tonnes (6)
- ○ Other (please specify) (7)

Measures

13. Over the last two years, did the company adopt any of the following measures to reducing the company's environmental impact? Please select all that apply.

- [ ] Heating and cooling improvements (1)
- [ ] More climate-friendly energy generation (2)
- [ ] Machinery and equipment upgrades (3)
- [ ] Energy management (4)
- [ ] Air pollution control measures (5)
- [ ] Waste minimization, recycling and waste management (6)
- [ ] Improvements to lighting systems (7)
- [ ] Upgrades of vehicles (8)
- [ ] Renewable energy technologies (9)
- [ ] Other (please specify) (10)

_____

14. Out of the measures adopted over the last two years, which measure has contributed the most to reducing the company's environmental impact? Please select three

- [ ] Heating and cooling improvements (1)
- [ ] More climate-friendly energy generation (2)
- [ ] Machinery and equipment upgrades (3)
- [ ] Energy management (4)
- [ ] Air pollution control measures (5)
- [ ] Waste minimization, recycling and waste management (6)
- [ ] Improvements to lighting systems (7)
- [ ] Upgrades of vehicles (8)
- [ ] Renewable energy technologies (9)
- [ ] Other (please specify) (10)

Amount spent

15. Over the last two years, how much money (in GBP) did the company spend on sustainability measures to reducing the company's environmental impact, if any?

- Nothing (1)
- £100 or less (2)
- £100 to £499 (3)
- £500 to £999 (4)
- £1,000 to £4,999 (5)
- £5,000 to £9,999 (6)
- £10,000 to £49,999 (7)
- £50,000 to £99,999 (8)
- £100,000 or more (9)
- Don't know (10)
- Prefer not to say (11)

Motivations

16. What motivated the company to adopt measures to reducing the company's environmental impact over the last two years, if any? Please select three

- [ ] Make a positive impact on an issue (1)
- [ ] Align with our goals, mission and values (2)
- [ ] Meet consumers' expectations (3)
- [ ] Attract, motivate, and retain employees (4)
- [ ] Meet industry standards on sustainability (5)
- [ ] Meet investors' expectations (6)
- [ ] Meet nongovernmental organizations' expectations (7)
- [ ] Meet expectations of supply-chain partners (8)
- [ ] Develop new growth opportunities (9)
- [ ] Improve operational efficiency (10)
- [ ] Respond to competitive pressure (11)
- [ ] Build, maintain, or improve business reputation (12)
- [ ] Conform to regulatory or legal requirements (13)
- [ ] Promote our ability to grow (14)
- [ ] Don't know (15)
- [ ] Other (please specify) (16)

Challenges

17. What were the main reasons for not adopting sustainability measures to reducing the company's environmental impact, if any? Please select three

- [ ] Not a priority relative to other investments (1)
- [ ] Not profitable (2)
- [ ] Not ready to invest (3)
- [ ] Lack of skills and knowledge to understand how climate change impact on business objectives (4)
- [ ] Lack of time (5)
- [ ] Customers are not asking for it (6)
- [ ] Not opportunity presented (7)
- [ ] Dissatisfaction with local government (9)
- [ ] Not believe in climate change (10)
- [ ] Lack of financial resources (11)
- [ ] Uncertainty about regulation (12)
- [ ] Uncertainty about future prices (13)
- [ ] Lack of guidance from the government (14)
- [ ] Operational and/or technical risk (15)
- [ ] Don't know (16)
- [ ] Other (please specify) (17)

MODULE 5. Local government

Local government priorities

18. What do you think are the priorities of the local government currently in your local area? Please select three.

- [ ] Promoting maximum employment (1)
- [ ] Ensuring the survival of local businesses (2)
- [ ] Maintaining roads and good infrastructure (3)
- [ ] Keeping interest rates low (4)
- [ ] Reducing poverty and economic inequality (5)
- [ ] Fighting climate change/global warming (6)
- [ ] Fighting infectious diseases (7)
- [ ] Achieving net zero goals (8)
- [ ] Other (please specify) (9)

19. Over the last two years, has your company taken advantage of any kind of support/grant/subsidy scheme in the fight against climate change?

- ○ No (2)
- ○ Don't know (3)
- ○ Prefer not to say (4)
- ○ Yes (please specify) (1) _____

20. What type of support from the local government would your company value the most in the fight against climate change? Please select all that apply

- [ ] Financial support (1)
- [ ] Less complex and onerous tendering process (2)
- [ ] Certainty around renewable energy incentives (3)
- [ ] More local sustainability programmes (4)
- [ ] More emissions trading schemes (5)
- [ ] Incentives for eco-friendly products (tax incentives, purchasing expansion of public agencies, etc.) (6)
- [ ] Dissemination of new technology information (7)
- [ ] More investment in green technology (8)
- [ ] More infrastructure building for joint facilities or green partnerships (9)
- [ ] Information about how to get to Net Zero goals (10)
- [ ] Other (please specify) (11)

21. Has the company received any funding or support from the following programmes?

Renewable Energy Technologies Fund	▼ Never heard of it (3) ... No (2)
Skills Support for the Workforce	▼ Never heard of it (3) ... No (2)
Business Scale Up	▼ Never heard of it (3) ... No (2)
York Go-Greener Fund	▼ Never heard of it (3) ... No (2)
Investment Fund	▼ Never heard of it (3) ... No (2)
Big Issue Event	▼ Never heard of it (3) ... No (2)
Key Fund	▼ Never heard of it (3) ... No (2)
Better Business Finance	▼ Never heard of it (3) ... No (2)

22. Do you think the local government is doing enough to help businesses in North Yorkshire to reduce carbon dioxide (CO2) emissions?

- ○ Yes (1)
- ○ No (2)
- ○ This is not a concern in my local council (3)
- ○ Don't know (4)
- ○ Prefer not to say (5)

MODULE 6. Feedback

23. If you would like to share any additional comments about the issues raised in this questionnaire or the questionnaire itself, please enter them below.

_____

Appendix C: *Workshop booklet*

BAM Performance Management SIG event
"Sustainability-related performance: Pathways to Net Zero"
Hybrid: both face-to-face and online
Thursday 15th September 2022
Lecture Theatre 103, Piazza Building, Campus East, Heslington, University of York, YO10 5GR
Programme

9:30 am Welcome, Prof. Jonathan Liu (SIG Chair)
10:00 am "Imagining Net Zero Futures and how to build your strategy to get there" Prof. Steve Evans, University of Cambridge
11:15 am coffee break
11:30 am "The UK Food Systems in 2050: Trends and Future Research for Net Zero" Prof. Sonal Choudhary, University of York
12:30 pm Lunch
1:30 pm Workshop 1: "Low carbon infrastructure and business growth: sectoral analysis" Dr Luisa Huatuco (University of York), **PZA/016**
1:30 pm Workshop 2: "The Paradox of Conservation and Control: Stakeholders and the Problem of Implementing Regulatory Policies" Dr Vinh Sum Chau (University of Kent), **PZA/017**
3:00 pm coffee break
3:15 pm "Managing significant threats in manufacturing industries - Disruption and recovery in complex systems"**,** Prof. Melanie Kreye, University of York
4:30 pm Drinks reception and Close

***Directions to the venue:**

Piazza Building - York Conferences

Prof. Jonathan Liu

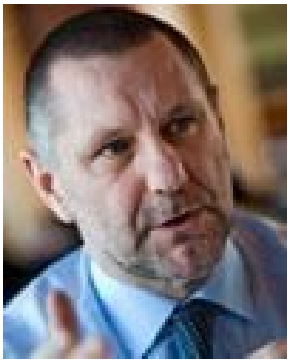
Jonathan is the BAM Performance Management SIG Chair, Chairman of the Board of Trustees at Ming-Ai (London) Institute and is responsible for the strategic direction of Ming-Ai. He is a founding Dean of the School of Management and Leadership, and Vice Provost at Elite Innovation College Cambridge. He is an adjunct Professor with the University of Wales, Trinity St David where he supervises research students.

Jonathan's email address: J.Liu@ming-ai.org.uk

Prof. Steve Evans

Director of Research in Industrial Sustainability, University of Cambridge

Steve has over 20 years of academic experience which includes working collaboratively with leading industrial and academic institutions from around the globe and supervising over 120 PhD. and MSc. students at Cranfield. His research seeks a deep understanding of how industry develop solutions that move us towards a sustainable future. He researches and conducts projects with organisations to improve their performance in various dimensions; recent work includes: Sustainable factories, Food systems for people with reduced access to food, Sustainable city re-generation design, Sustainable design and operations for mainstream car manufacturers, and Cars with water for exhaust that do 300mpg (equivalent).



Steve's email address: se321@cam.ac.uk

Prof. Sonal Choudhary

Prof Sonal Choudhary is a Professor and Chair in Sustainable Management at the University of York Management School (UYMS). With a core expertise in Agri-food Supply Chain Management, she has an interdisciplinary background in plant sciences, ecology, environmental sciences, GIS & Remote sensing, and works at interface between these disciplines to generate impact on policy and businesses. Most of her research is now focusing on '*Innovations for enhancing resilience and sustainability of Food Systems'* at multiple scale, with a particular focus on **Net Zero**. She has led **10 projects as PI** worth a total of **>£2M** and contributed to 7 other projects as Co-I, totalling **>£12M**. Prof Choudhary is currently Principal Investigator for two large interdisciplinary STFC-funded projects: *TRAnsforming Cold Food Chains in INdia through Space Science and TechNologies* **TRANSSITioN** and STFC Food Network+ Phase 2 (**SFN 2.0**) and is a Work Package lead on £6m BBSRC (Strategic Priority Fund) funded **Healthy Soil, Healthy Food and Healthy People (H3)**. These projects are addressing country-specific research priorities in sustainable food security area with multi-stakeholders as partners in the UK, countries in Asia and Africa for generating impact. Besides, she is also working with WWF-UK (along with all major retailers in the UK), FSA and Defra on short-term industry and policy-focused projects on transformation towards sustainable and safe food systems.

Sonal's e-mail address: sonal.choudhary@york.ac.uk

Dr Luisa Huatuco

Luisa Huatuco is a Reader in Operations Management. Her research expertise in Manufacturing Systems Complexity is the context for several topics: Sustainability, Resilience, Disruptions, and Performance. She is a Co-Track chair of the British Academy of Management conference, Performance Management track. She has published in: *International Journal of Production and Operations Management, European Journal of the Operational Research Society, International Journal of Production Economics, International Journal of Production Research, and Production Planning and Control*, as well as in several international conferences. She has also been fostering links with researchers in Latin America and Europe. She is a Co-Editor for the *International Journal of Productivity and Performance Management* (IJPPM).

Luisa's e-mail address: luisa.huatuco@york.ac.uk

Dr Vinh Chau

Vinh Sum Chau is a Senior Lecturer in Strategy at the Kent Business School, University of Kent (UK). He is an area editor (strategy and organization) of the *European Management Review* and formerly an associate editor of *British Journal of Management*; he is the Deputy Chair of the British Academy of Management's special interest group and currently annual conference co-track Chair in Performance Management.
Dr Chau's main research focus is on strategic performance management and implementation. His publications include the *British Journal of Management*, *International Journal of Operations and Production Management*, *Applied Psychology*, and *Asia Pacific Journal of Management*. His co-authored textbook, *Strategic Management: Principles and Practice*, was the bestselling '2010 new concise management textbook', now in its second edition in EMEA and a Chinese edition in Asia.

Vinh's e-mail address: V.S.Chau@kent.ac.uk

Prof. Melanie Kreye

Melanie Kreye is a Professor and Chair of Operations and Supply Chain Management at the University of York Management School. She joined the school from The Technical University of Denmark. She further holds an external position at the Manchester Business School, The University of Manchester. Her research focuses on services and their role in creating a sustainable future. Her research has been published in peer-reviewed journals such as *Omega – The International Journal of Management Science*, *The International Journal of Operations & Production Management*, and *Production Planning and Control*. She is an Associate Editor at the *International Journal of Operations and Production Management* and a Board Member at the European Operations Management Association (EurOMA).

Melanie's e-mail address: melanie.kreye@york.ac.uk

Appendix D: *Workshop list of delegates*

BAM Performance Management SIG event, York, 15th September 2022

Title	First name	Surname	Affiliation
Mr	Olugbemiga Daniel	Alabede	Cranfield University
Dr	Adriana	Atkinson	University of York
Ms	Anna	Bajo	University of York
Dr	Claire	Brewis	Coventry University
Mr	Juan Ramon	Candia	University of York
Mr	Garry	Carr	Leeds Beckett University
Dr	Vinh	Chau	University of Kent
Prof.	Sonal	Choudhary	University of York
Dr	David	Curbelo Perez	Global Banking School
Prof.	Steve	Evans	University of Cambridge
Dr	Emma	Green	Leeds Beckett University
Mr	Gordon	Gunn	Sylatech
Ms	Helen	Guthe	Kepwick farm Ltd
Mr	Alex	Guthe	Kepwick farm Ltd
Mr	Jasper	Hasell	Castle Howard Estate
Dr	Luisa	Huatuco	University of York
Mr	Charlie	Hunt	Homes for students
Dr	John	Issitt	University of York
Mr	Mark	Kibblewhite	North Yorkshire County Council
Prof.	Melanie	Kreye	University of York
Dr	Xiao	Lin	University of York
Prof.	Jonathan	Liu	Ming-Ai (London) Institute
Dr	Ruby Christine	Mathew	University of York
Dr	Eyob	Mulat-Weldemeskel	London Metropolitan University
Ms	Clare	Murgatroyd	University of York
Ms	Katie	Noble	University of York
Dr	Luca	Sabini	University of Leeds
Ms	Amanda	Selvaratnam	University of York
Mr	Joe	Simpson	University of York
Dr	Rosina	Watson	Cranfield University
Miss	Xinger	Wei	University of Manchester
Mr	Simon	West	Homes for students
Ms	Linqi	Xu	University of York
Dr	Miying	Yang	Cranfield University
Dr	Graciela	Zevallos	University of East Anglia