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Have sustainable health systems met their potential benefits? (A European perspective)

Master Thesis for Obtaining the Degree

Master of Science in

Sustainable Development, Management, and Policy

Submitted to Dr David Leonard

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Affidavit

I hereby affirm that this Master's Thesis represents my own written work and that I have used no sources and aids other than those indicated. All passages quoted from publications or paraphrased from these sources are properly cited and attributed.

The thesis was not submitted in the same or in a substantially similar version, not even partially, to another examination board and was not published elsewhere.

Abstract

In delivering healthcare services to meet and maintain the health needs of populations, health systems contribute significantly to environmental, social, and economic detriment. Improving health system sustainability through the appropriate pathways would serve to mitigate these impacts. This study investigated the progress and actualised benefits of a health system having recently implemented sustainability reforms through a case study approach, supplemented by expert input to inform the interpretation. The analysis revealed that although significant benefits have been realised as a result of the transition towards greater health system sustainability, the full potential of these benefits has not yet been met. In addition to the actions currently undertaken to effectively improve health system sustainability, a proactive approach to healthcare involving a greater emphasis on disease prevention and health promotion is strongly needed.

To my parents, whose continued dedication to improving healthcare in developing nations acts as a source of inspiration to all those around them.

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1. Introduction

“Ultimately, the whole report is about health,” noted Gro Harlem Brundtland in summary of the 1987 Brundtland Report by the World Commission on Environment and Development (WCED) (Price and Tsouros, 1996). The realities of sustainable development are closely interrelated with health and health promotion (Weisz et al., 2011). The WCED defines sustainable development as “development which meets the needs of current generations without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development [WCED], 1987).

Not only is health a rudimentary human right, but it is also a crucial element of sustainable human development and the economic evolution of societies (Popescu et al., 2018). Through the promotion of social cohesion, increase in productive employment, and reduction of medical expenses, health significantly impacts the development of a nation (Popescu et al., 2018). Estimates place return on investment (ROI) in health from improved economic growth in low- and middle-income countries from 2000 to 2011 at nine to one (Kieny et al., 2017). Due to the significance of health and healthcare within the economic activity of nations, health could potentially prove to be a means of evaluating a nation’s progress towards achieving sustainable development (Popescu et al., 2018).

A health system comprises all public and private institutions and resources entrusted to improve, maintain, or restore a target population’s health (World Health Organisation [WHO], 2017). Health system durability faces the challenges of accelerating rates of chronic disease, ageing populations, low-

value care, increasing costs, inefficiencies, wasteful spending (Braithwaite et al., 2019), increasing technology-driven demand, workforce capacity and funding, quality and safety concerns, and lack of preventive healthcare (Fischer, 2014). The ability to sustain health systems in their current projected state of operation will continue to become increasingly gruelling (Braithwaite et al., 2019).

The opportunities for increased sustainability within healthcare systems, notably hospitals, are abundant (Weisz et al., 2011). This has been identified in medical cradle to grave life cycle assessment studies, detailing the impact of hospital activities (McGain & Naylor, 2014). Hospitals play an integral role in healthcare systems, with obvious public benefits, yet they also contribute significantly to negative environmental, social, and economic impacts, ironically placing further burden upon public health in the process (Weisz et al., 2011). Common themes identified within the topic of hospital sustainability include hospital (green building) design, direct energy and water consumption, waste management, travel emissions, procurement strategies, and psychology and behaviour (McGain & Naylor, 2014).

To incorporate the principles of sustainability into hospitals, healthcare experts aim to examine the balance between the socio-ecological nature of sustainable development and the reality of hospital operations (Weisz et al., 2011). A major aim of sustainable development within hospitals is to avoid the unintended long-term negative impacts and side effects of healthcare (which is in itself the goal of hospitals) and maximise positive impacts and health gains by instilling sustainability and health promotion at the core of hospitals (Weisz et al., 2011).

Through the incorporation of sustainable practices, hospitals are able to improve their future viability and contribute to global sustainability (Weisz et al., 2011). However, in light of health, safety, and quality, uncertainty continues to surface in terms of the functional application of sustainability concepts within healthcare services and whether these concepts are in line with healthcare outcomes (Hussain et al., 2018).

Countries within the European Union aim to provide quality healthcare to all individuals through their healthcare systems, paying particular attention to those in poverty by ensuring healthcare costs do not trigger significant financial constraints (Popescu et al., 2018). These measures guarantee the economic prosperity of nations and the well-being of their people through enhanced labour market participation and productivity, both significant factors which encourage the prolongment of active lifestyles within the ageing societies of some nations (Popescu et al., 2018). Additionally, health systems are vital for realising economic cohesion and social protection processes within Europe (Popescu et al., 2018).

At the time of writing this thesis, the global population faced a myriad of crises, most notably the climate crisis and the COVID-19 pandemic. Once the COVID-19 pandemic took hold, health systems began resource-heavy operations on the treatment of those infected, the development of antivirals and vaccines, the rapid manufacturing and acquisition of ventilators, and the expansion of budgets and funding (Gates, 2020). The aversion of one crisis, however, potentially exacerbated the other. These crises further exhibit the interrelations of health systems and their surrounding environment. Weak health systems which lack resilience significantly exacerbate the impact of natural and humanitarian disasters, as was seen with the 2012 Middle East

Respiratory Syndrome coronavirus, 2013 - 2016 Ebola virus disease, and 2015 Zika virus outbreaks (Kieny et al., 2017).

Nationwide lockdowns and finances either drying up or relocating to health system operations are forecasted to cause a decline in renewable investments (Gillingham et al., 2020). Delays in clean energy technology and vehicle fuel investments could potentially cause long-run carbon dioxide (CO_2) and local air pollutant emissions equating to an additional 2,500 million metric tons (MMT) of CO_2 cumulatively and 7,500 air-quality related deaths from 2020 to 2035 (Gillingham et al., 2020).

Additionally, in the likelihood that the pandemic causes a persistent economic recession, climate change mitigation targets could potentially see a relaxation due to intense pressure (Gillingham et al., 2020). These long-term impacts of the COVID-19 pandemic would quickly outweigh any short-run reductions, thereby indirectly contributing to the climate crisis.

1.1. Research Question and Aim of this Master Thesis

The research question “Have sustainable health systems met their potential benefits?” and subsequent aim of this thesis is to assess whether health systems (in the European region) have realised the potential benefits of a sustainable approach to healthcare laid out in the literature through the implementation of systemic, sustainable reforms. The analysis of sustainable health systems is conducted based on available literature, expert opinions, and case study data revealing the real-life contexts of sustainable healthcare.

An in-depth expert interview with Willi Haas, Dipl. -Ing., Dr phil., from the University of Natural Resources and Life Sciences in Vienna, Austria is also presented. The interview was conducted to improve on this paper's theoretical and practical understanding of health system sustainability. Additionally, a case study of an existing health system that has implemented sustainable practices, the Manchester University National Health Service (NHS) Foundation Trust, forms the main body of the research analysis. This case study allows for the detailed evaluation of health system sustainability reforms and the realisation of their potential benefits within a practical, real-life context. Dr Haas' expert opinions on the case study are also presented, offering additional insight into the situation.

In conclusion, this thesis looks at whether health systems have actualised and met potential benefits through the implementation of sustainable reforms. The knowledge gained from this study could be beneficial to researchers, policymakers, students, healthcare professionals or other healthcare stakeholders interested in the value of sustainable healthcare practices and their actualised merits. In addition, the analyses of health systems could potentially spread awareness on the benefits of increased sustainability within the healthcare sector. This awareness could lead to the prevention of ineffective operations and an increase in readiness through the improvement of policies, training, and procedures within health systems.

1.2. Reasons and Needs for the Research Study

Numerous aspects of sustainable healthcare such as structural features, assessment standards and criteria, incentives, implementation, waste management, resilience to climate change, patient and workforce comfort, and indoor environment have been identified and studied in previous research. There is, however, further opportunity to gain additional knowledge on the actualised benefits of sustainable health systems, which have, for the most part and until recent times, only been theorised by industry experts.

The overarching field of health system sustainability has received much recognition, especially by governing bodies. However, complete knowledge of the outcomes following the implementation of sustainable practices in the health sector is lacking. The majority of researchers, while acknowledging sustainability within health systems and its potential benefits and barriers, have focused their studies on the opportunities and steps for sustainability within health systems, including the development of action plans. Since healthcare systems would have needed sustainable action plans in order to begin sustainable operations, this previous focus makes logical sense.

Sustainability within the health sector is vital in order to reduce environmental pressures, improve wellbeing and health, preserve resources, and cut costs in the face of a rapidly deteriorating environment. As more and more healthcare facilities implement sustainable practices, the relative outcomes available for analysis increases. A study on the extent and efficacy of such reforms could be used by relevant stakeholders to further foster sustainability within health systems.

The knowledge gained through this study could potentially spread awareness on health system sustainability and assist policymakers, healthcare stakeholders, scholars, or practitioners in further fostering sustainable practices in the health sector. The overall burden resulting from healthcare services could be reduced as health systems implement the most effective and efficient sustainability practices.

A literature review of the current knowledge on health system sustainability will follow this introduction. Following this, a methodology section will detail the procedures which were used to investigate the research problem. Thereafter, an expert interview with Dr Willi Haas from the University of Natural Resources and Life Sciences in Vienna, Austria, and a case study on England's Manchester University NHS Foundation Trust will be presented. Lastly, a conclusion will follow to clarify the intent and importance of this paper.

2. Literature Review

2.1. Negative Impact of Health Systems

2.1.1. Environmental Impact

Health systems are essential in maintaining the health and welfare of current and future human beings in society, playing a significant role in supporting societal development and economic growth (WHO, 2017). To do so, however, health systems require significant volumes of energy and resources. Further, the services offered by health systems are counteracted by its extensive environmental pollution, whether that be directly or through

the disposal, procurement, and consumption of goods and services (WHO, 2017).

There is clear evidence to support the reality that health system activities significantly contribute to adverse environmental impact and pressures (WHO, 2017). The main actions of health systems that contribute to these environmental pressures include conventional and hazardous waste disposal, greenhouse gas emissions, wastewater generation, and high resource-consumption (WHO, 2017). Environmental pressures, climate change, in particular, pose a double risk to health systems (Weisz et al., 2011). Firstly, increasing environmental pressures will lead to greater regulatory measures, stricter environmental guidelines, and escalating prices (Weisz et al., 2011). Secondly, health systems will face uncharted and adverse climate-related effects on public health (Weisz et al., 2011).

Among healthcare providers and facilities, hospitals, specifically, contribute significantly to environmental (as well as social and economic) impacts (Weisz et al., 2011). A factor to consider and one that differentiates healthcare facilities in terms of pollution prevention is that they do not manufacture a product, operate a fabrication process, or generate waste materials that are readily recycled, reused, and reprocessed (Allen, 2006). As a result, numerous traditional pollution prevention opportunities available, used mainly by industrial facilities, are not suitable for healthcare facilities as they do not conduct traditional manufacturing and processing operations (Allen, 2006).

2.1.1.1. Waste Disposal

The healthcare sector is one of the largest generators of waste, with disposals consisting of both hazardous and non-hazardous waste (WHO, 2017). Around 75-90% of healthcare waste is comparable to domestic waste in terms of its make-up and environmental implication (Eker and Bilgili, 2011). The remaining 10-25% of healthcare waste consists of hazardous waste, which poses a much more significant threat to the wellbeing of society and its environment due to its potentially toxic, infectious, or radioactive nature (Eker and Bilgili, 2011).

The main obstacle in terms of sustainably managing healthcare waste remains to be its method of disposal. Healthcare waste materials are potentially one of the greatest dangers to environmental pollution due to their infectious nature (Eker and Bilgili, 2011). Patients, hospital staff (notably waste workers), neighbouring communities, visitors, and the surrounding environment face exposure to considerable risk through mismanaged disposal of infectious components (Eker and Bilgili, 2011).

Disposal of waste into landfills, although the most cost-effective option, has shown to negatively affect the environment and population health (WHO, 2017). Incineration of hazardous waste is currently considered the most environmentally friendly method of waste disposal for healthcare facilities. However, this method of disposal also harbours limitations. Ash produced from the incineration of hazardous healthcare waste was found to contain variable levels of pollutants, in addition to high levels of heavy metals (WHO, 2017).

Due to developing healthcare technology and the increased use of disposable products, hospital waste generation is rising (Eker and Bilgili, 2011). A significant factor contributing to the increasing levels of waste generated by hospitals is the use of disposable instruments and pre-packaged materials (WHO, 2017). Evidence suggests that the levels of waste generated by hospital inpatient facilities per bed-day ranges extensively, irrespective of hospital size or type (WHO, 2017). Rather, the potential factors affecting medical waste generation may include occupancy rate segregation systems, location, and services provided (Eker and Bilgili, 2011).

In addition, there has been a growing trend in the levels of clinical waste generated in community settings, such as private households, due to a shift in providing medical services outside of hospital settings (WHO, 2017). As a result of this shift, waste disposal practices are currently lacking, as no or few frameworks have taken this updated method of medical service delivery into account (WHO, 2017).

Evidence indicates that high-income countries in Europe generate larger quantities of healthcare waste per capita compared to low- and middle-income nations (WHO, 2017). However, these high-income countries have shown to more effectively dispose of healthcare waste with further developed regulatory frameworks (WHO, 2017). In comparison, low- and middle-income nations have experienced adverse population health effects as a result of mismanaged healthcare and domestic waste disposal (WHO, 2017). The advancement of regulatory and technical frameworks in the field of healthcare waste disposal has gained rapid momentum within Europe (WHO, 2017).

2.1.1.2. Greenhouse Gas Emissions

The linkages between climate change and human health run deep, with the situation of one playing a pivotal role in the state of the other (Pichler et al., 2019). Climate change impacts such as floods, fires, droughts, heatwaves, storms, altered infectious disease patterns, food shortages, and air pollution consequently causes an increase in the demand for healthcare services (Pichler et al., 2019).

Causing around 150,000 deaths per year with the possibility of creating further conflict (Pollard et al., 2014), the climate change crisis has been recognized by authors as the greatest threat to human health in the 21st century (Watts et al., 2015). This increasing burden will continue to pressure already stressed healthcare systems within many regions around the globe (Pichler at al., 2019). Climate change mitigations and public health policies that benefit the climate and public health include a reduction of greenhouse gas emissions, diet changes, and a shift towards active mobility (Pichler et al., 2019).

Much like other service sectors, the healthcare sector exhibits relatively low direct emissions (WHO, 2017). Aside from direct energy use within healthcare facilities, health systems generate the bulk of their greenhouse gas emissions through embedded emissions along their supply chain, such as the procurement of goods and patient and personnel travel (WHO, 2017). Having said that, the issues of anaesthetic gases and pressurised metered-dose inhalers and their contributions to greenhouse gas emissions remains a significant topic within the literature on health system sustainability.

A study on the CO_2 emissions resulting from patient, employee, and visitor trips to and from hospitals and ambulatory healthcare provisions in Austria for the years 2005, 2010, and 2015 revealed that induced travel caused approximately an equivalent amount of CO_2 emissions as the healthcare sector's direct energy consumption (Weisz et al., 2020). This totalled an increase in induced travel CO_2 emissions by 15% from 2005 to 2015 (Weisz et al., 2020). The upward trend was due to an overall higher demand for healthcare, an increase in the distance of trips (resulting from a centralised healthcare strategy to increase efficiency and quality), and a decrease in the nation's private car fleet energy efficiency (Weisz et al., 2020). The social aspect of ageing in rural areas further adds to the issue of ambulatory healthcare, highlighting a social dimension to the environmental costs of healthcare provision (Weisz et al., 2020).

Research conducted on the carbon footprints of specific services and patient pathways in hospitals within Europe, notably those of high-income nations, displayed the lack of published carbon accounting by hospitals at the time (WHO, 2017). Additionally, attention to healthcare emissions was not prevalent within climate mitigation literature (Watts et al., 2015). While there have been studies on individual areas of care (such as respiratory department, intensive care unit, and renal care) and their subsequent carbon footprint, rarely have there been studies conducted on wider healthcare systems (Pollard et al., 2014).

As of 2017, the only health system in Europe to have undertaken and published a systemic carbon accounting exercise was the United Kingdom's NHS (WHO, 2017). The NHS produced 24.7 million tonnes of CO_2 emissions in 2012, approximately equivalent to the nation of Croatia's total greenhouse

gas emissions for the same year (WHO, 2017), and is responsible for 30% of England's public sector carbon emissions (Pollard et al., 2014). Albeit its numerous and sizable estates, the NHS has pledged an 80% reduction of its carbon footprint by 2050 (Pollard et al., 2014). This accomplishment would reap additional health co-benefits as a result of health sector mitigations and the transition to becoming a climate-resilient health system (Costello et al., 2009).

2.1.1.3. Wastewater Generation

Hospital wastewater contains a multitude of pollutants, including heavy metals, pharmaceutical products, microorganisms, cleaning agents, and other chemicals such as free chlorine and organic halogens (WHO, 2017). Healthcare facilities produce wastewater through multiple streams. While it is evident that healthcare facilities directly generate wastewater, there are also sources of indirect water pollution that typically occur. Indirect wastewater generation could occur through activities within the health system supply chain, health system activities conducted by patients, or poor healthcare waste disposal (WHO, 2017).

Conventional water treatment plants are usually not able to remove a large number of pharmaceutical compounds present in medical wastewater, leading to significant opportunities for unmetabolized pharmaceutical compounds to impact the environment negatively (WHO, 2017). A wastewater study of four healthcare facilities (hospital, nursing care, assisted living, and independent living) indicated that seven out of eight analysed steroid hormones were present in at least one of the facilities (Nagarnaik et al., 2010). The hospital composite sample contained the highest measured concentration of each analyte except for one (Nagarnaik et al., 2010).

As the majority of healthcare facilities link to and rely upon municipal and wastewater servers, there is a significant impact on the municipal wastewater treatment plants and the effluent quality objectives by which they are governed (Allen, 2005). The severity of this impact is dependent on the environmental quality of hospitals' sanitary sewage discharge (Allen, 2005).

2.1.1.4. Hazardous Chemicals

The healthcare sector utilizes a multitude of hazardous chemicals, including and not limited to mercury, phthalates, flame retardants, polyvinyl chloride, and volatile organic chemicals (WHO, 2017) for the purposes of diagnostics, therapy, prophylaxis, and lifestyle or cosmetic modifications (Daughton, 2009). Of great concern are toxic chemicals known as endocrine-disrupting chemicals (EDCs), of which experts heavily debate safe levels of exposure (WHO, 2017).

Several countries within Europe have chosen to tread on the side of caution, phasing out the use of certain EDCs in medical equipment, notably in regard to maternity, neonatal, and paediatric care uses (WHO, 2017). Heavy metals, particularly mercury, are heavily prevalent within healthcare activities. Mercury use in the healthcare system is estimated to contribute to a third of mercury emissions in wastewater as well as 10% of all mercury air releases (WHO, 2017). Experts sharply criticize the use of mercury as there are alternatives available for the majority of its applications (WHO, 2017).

Long-term exposure to hazardous chemicals such as sterilizing agents and disinfectants led to higher incidences of occupational asthma and dermatitis for healthcare professionals (Wilburn and Eijkemans, 2004). Based on the

European Community Respiratory Health Survey (ECRHS), a large population-based international study, nurses who reported utilizing bleach or ammonia experienced an elevated risk of new-onset asthma (Arif and Delclos, 2012).

As a major consumer of these chemicals, several of which have proved to affect human health and the environment negatively, it comes as no surprise that potential for impact materializes throughout the complete life cycle (manufacturing, use, and disposal) of products and services utilizing these chemicals (WHO, 2017). Although individual sources alone may not contribute to significant quantities, the combined inputs of chemicals could lead to measurable levels in waters as well as other environmental compartments (Daughton, 2009).

As a result, humans, wildlife, and microbiota face increased situations to chronic, low-level ambient chemical exposure, with some circumstances posing a risk for high-level, acute exposures (Daughton, 2009). Those most at risk include vulnerable populations often exposed to these chemicals, including patients, healthcare professionals, waste disposal staff, and those living within proximity to manufacturing plants or waste disposal sites (WHO, 2017). The risks of chemical exposure and its vast spectrum of modalities are difficult to interpret due to the complexities of simultaneous exposure to numerous chemical stressors (Daughton, 2009).

Measurements of more than forty volatile organic compounds (VOCs) collected from a hospital in France (from six sampling sites, including a reception hall, patient room, post-anaesthesia care unit, nursing care, flexible endoscope disinfection unit, and parasitology-mycology laboratory) indicated

that concentrations were, although containing a complex mixture of VOCs, at a lower level known to be harmless to humans (Bessonneau et al., 2013).

However, although levels of chemicals present may be below those known to affect biological processes, the possibilities of delayed-onset or difficult-to-treat, subdued symptoms presenting themselves should not be eliminated (Daughton, 2009). A greater understanding of the relationship between exposure to complex mixtures of chemical compounds by healthcare professionals and patients to potential health outcomes is needed (Bessonneau et al., 2013).

In some cases, there is no feasibility for certain chemicals to be substituted (WHO, 2017). In other instances, however, the use of less hazardous alternatives when possible could lead to greater cost-effectiveness, reduction of exposure, and a step towards nations meeting their obligations under international environmental agreements (WHO, 2017). Such agreements include the Stockholm Convention on Persistent Organic Pollutants and the Minamata Convention on Mercury (WHO, 2017). Established in 2013, the Minamata Convention on Mercury aims to reduce mercury pollution amongst its 128 nation members (WHO, 2017).

2.1.1.5. High Resource-Consumption

Healthcare facilities are exceedingly energy-intensive, requiring on average double the energy of homes and offices (D'Alessandro et al., 2016). Energy is used by healthcare facilities to provide lighting, heat water, power medical equipment, and supply air-conditioning and heating (D'Alessandro et al., 2016). As such, the identification and implementation of innovative design

solutions and management is crucial for the sustainable management of energy in health systems (D'Alessandro et al., 2016).

In terms of water consumption, health systems consume significantly less in comparison to other sectors (WHO, 2017). England's NHS, for example, is accountable for 1.3% of the nation's total water consumption (WHO, 2017). However, due to the significant daily water requirements of healthcare facilities and their numerous applications, water consumption plays an integral role in the energy management of healthcare facilities (D'Alessandro et al., 2016).

Despite the relatively low direct water consumption by healthcare facilities, evidence suggests that embedded water consumption is decidedly more significant (WHO, 2017). The manufacture and procurement of goods for healthcare systems, as well as the generation of electricity, are typical examples of embedded activities which could contribute to the higher levels of indirect water consumption (WHO, 2017). To illustrate, the significant use of disposal cotton goods in a healthcare system could lead to a considerable embedded environmental impact, due to the highly water-intensive nature of cotton crop cultivation (WHO, 2017).

Factors that influence the amount of water used in hospitals include number of beds, hospital age, access to water, number and type of wards and units, general services provided within the facility, institutional management policies, environmental awareness of management, culture, climate, and geographical factors (D'Alessandro et al., 2016). To sustainably manage water resources, health systems would need to quantify the amount and

proportional usage of water within healthcare facilities to promote the conservation, recycling, and reuse of water (D'Alessandro et al., 2016).

Water and energy expenditures totalled 2.2 billion Euro for German hospitals (González et al., 2018). Comparatively, Spain revealed energy expenditures in the hospital sector of 600 million Euro while Austrian hospitals reported similar results to German clinics, with energy costs of 1.5 billion Euro (energy consumption of 5,800 kWh of electricity and 28,000 kWh of heat per bed, per year) (González et al., 2018).

Of the 60 billion Euro total annual expenditure costs for 2,100 German hospitals, 1.5 billion Euro was dedicated to energy consumption (González et al., 2018). At the time, a hospital bed in Germany required 6,000 kWh of electricity and 29,000 kWh of heat per year, equivalent to the yearly heating requirement of two single-family homes (González et al., 2018). It was estimated that approximately 40% of electricity and 32% of heat from these healthcare facilities could be conserved, depending on the condition, construction, and size of the buildings (many of which required renovations) (González et al., 2018).

As numerous healthcare facilities in Germany have become obsolete and lack an optimized energy supply, the possibilities for increased efficiency are considerable (González et al., 2018). The potential for energy-saving through thermal and electrical energy management within public hospitals in Germany was not yet studied systematically (González et al., 2018).

Additionally, an Italian study of hospitals in the Lombardy region revealed that not all facilities were able to provide data on their water consumption,

even though 90% of the facilities were installed with flow meters (D'Alessandro et al., 2016). Although water management was viewed as important in many of the healthcare facilities, few of them had implemented control systems or preventative measures to reduce water consumption (D'Alessandro et al., 2016). Further, the few basic measures that were implemented, such as common flow reducers and retrofit toilet discharge systems, were not sufficient to combat the complex structure and water-heavy activities of the healthcare facilities (D'Alessandro et al., 2016). Feedback from the investigation showed that management in the Technical Office department (and assumedly health personnel and Energy department managers as well) were aware of the poor efforts to reduce consumption, and despite this knowledge, did not seek to initiate improvements in terms of water resource management (D'Alessandro et al., 2016).

Continuing with the investigation of Italian hospitals within the Lombardy region, results revealed that despite the majority of interviewers being in favour of greywater reuse, only 11% of the healthcare facilities involved in the survey implemented the reuse of greywater (D'Alessandro et al., 2016). The other 89% of hospitals did not participate in greywater reuse due to several reasons (D'Alessandro et al., 2016). Firstly, due to the old age of the facilities, water plants were subsequently not designed to spare greywater (D'Alessandro et al., 2016). Secondly, the hospitals believed that the reuse of greywater could potentially lead to a risk of infection for their users (D'Alessandro et al., 2016). Lastly, the facilities believed the reuse of greywater to be too expensive (D'Alessandro et al., 2016).

Hospital-based care has shown to be the costliest, CO_2-intensive form of healthcare provision (Weisz et al., 2020). A study on eight consumption

categories in hospitals within the Austrian healthcare sector revealed that purchases of medical goods and services and pharmaceuticals, and the consumption of energy services were the highest contributors to the carbon footprints of hospitals (Weisz et al., 2020). In an effort to reduce emissions, hospitals have often focused on savings in areas that are not healthcare specific (such as insulation, heating, and cooling) (Weisz et al., 2020). Subsequently, emission reduction in the areas of pharmaceutical-use and medical treatment is lacking and remains a considerable potential for greater emission reductions (Weisz et al., 2020).

To continue with the example of Austria (which has one of the highest hospitalisation rates, number of hospital beds, and length of hospitals stays within the EU), it is the case that a significant share of admissions is avoidable and manageable by primary care (Weisz et al., 2020). In Austria's situation, this is due to a weak outpatient primary care sector provided mainly by contracted solo practitioners (Weisz et al., 2020). Relocating unnecessary hospital-based healthcare to alternative forms of healthcare provisions, which are less expensive and less carbon-intensive, could significantly reduce costs and carbon footprints within the healthcare sector (Weisz et al., 2020).

In conclusion, health systems are particularly energy-intensive due to their operational and setting specificity (WHO, 2017). This intensive use of energy holds for both the direct and indirect consumption of energy by healthcare facilities (WHO, 2017). As a result of this, environmental pressure and impacts across the life cycle of health system products and inputs increases (WHO, 2017).

2.1.2. Social Impact

Social sustainability is considered a relatively new concept within the service sector, particularly within the healthcare sector (Hussain et al., 2018). Within the context of health systems, social sustainability relates to the quality of life of its stakeholders, the potential social consequences of any decisions made by relevant decision-makers (Hussain et al., 2018), and the ability to address these needs in a way that secures its nature and regenerative abilities in the long-term (Maghsoudi et al., 2020).

The decisions made by decision-makers should take into account the fundamental opportunity of each person to experience a full existence in terms of physical, emotional, intellectual, and spiritual health (Hussain et al., 2018). Consequently, social sustainability is regarded as a key indicator of quality (Maghsoudi et al., 2020).

All stakeholders of a health system (employees, patients, community, suppliers, owners, and government) and their perceptions are relevant in the motivation or obstruction of its social sustainability (Hussain et al., 2018). This collaboration amongst healthcare actors to tackle challenges and improve social sustainability, for example, has also been referred to as collaborative healthcare (Maghsoudi et al., 2020).

Results confirm that, rather than an individualistic approach, a comprehensive analysis of all health system stakeholders' perceptions on social sustainability would prove much more beneficial and, further, would assist healthcare managers in balancing the expectations of all parties involved (Hussain et al., 2018).

"Decalogue of the Hospital of the Future", a research project coordinated in Italy in 2000 by Prof. Veronesi, Dr Mauri, and Arch. Piano highlighted that the key elements of the social sphere within hospitals were Sociability (belonging and solidarity), Humanisation (user-centred), and Organisation (effectiveness, efficiency, and perceived well-being) (Capolongo et al., 2016).

Health systems face a myriad of social challenges, particularly an unfair distribution of resources and an increasing demand for healthcare (Maghsoudi et al., 2020). Literature has shown that healthcare organisations suffer from a culture that is low in trust and limited in collaborative efforts at both the professional and organisational level (Maghsoudi et al., 2020). Additionally, the psycho-social aspects of healthcare facilities and their effects on the relationships with their users is often neglected, even by the most recognised international evaluation tools (Capolongo et al., 2016).

2.1.2.1. Human Resources for Health

Health system effectiveness and the enhancement of population health, notably the United Nations Sustainable Development Goal 3 (health and wellbeing), relies on an appropriately skilled, supported, and deployed health workforce (WHO, 2017a). The COVID-19 pandemic emphasised the value of health workers within societies, forming the backbone of our health systems (Bourgeault et al., 2020). As key responders to crises and first in line at points of care, health workers are also those most at risk (Bourgeault et al., 2020).

The European Region and its policymakers face numerous HRH hurdles; however, these challenges are not experienced equally amongst Member

States (Buchan & Perfilieva, 2015). Challenges include skill shortages, unbalanced geographic distribution, workforce sustainability, motivation, retention, skill mix, health workforce effectiveness, health workforce education transformations to meet population health needs, and health worker mobility and migration (Buchan & Perfilieva, 2015). Inequity in the access to human resources for health (HRH) leads to a decrease in access to healthcare services and, subsequently, a deterioration of its quality and health benefits (Rój, 2020).

The geographical distribution of HRH plays a significant role in the sustainability of health systems, as economic and social consequences for the well-being of present and future generations arise as a result of inequitable access to a physician and thus inequitable access to healthcare services (Rój, 2020). Sustainable development in this aspect therefore requires actions that support equitable HRH distribution (Rój, 2020).

In order to tackle HRH challenges, health workforce flows would require effective monitoring, improved workforce planning in line with the transformative education of health workforces, and an effective retention, skill, and distribution mix to improve the overall health workforce performance (Buchan & Perfilieva, 2015). HRH is accountable for expending a majority of the financial resources available to the health sector (Rój, 2020). Due to the labour-intensive nature of health services, human resource spending accounts for 60-80% of recurrent expenditure within health systems (Buchan & Perfilieva, 2015).

Burnout, level of cooperation, and job satisfaction are indicators of social sustainability within healthcare systems (Baumgardt et al., 2015). Employees

within the medical field are more likely to experience the progression from dissatisfaction to disillusionment, and finally to burnout, in comparison to the general population (Hassan, 2014). Quality of care is greatly influenced by burnout, drastically increasing the likelihood of medical errors (Hassan, 2014).

Deterred by the mounting pressures faced by health systems and healthcare employees alike, trainees are becoming less attracted to the idea of joining health workforces and their unsustainable demands (Hassan, 2014). As a result, the delivery of effective care in various healthcare departments has become compromised, and a recruitment crisis has developed (Hassan, 2014). This development requires increased support strategies in order to create a sustainable and satisfying working practice (Hassan, 2014).

Less money is spent on the social sector (partly due to availability), and global staff levels are in decline (Baumgardt et al., 2015). In England, psychiatrists fall under the “national shortage occupation” list and within the greater United Kingdom (UK), recruitment is declining, with one in seven positions remaining vacant or filled by locums (Baumgardt et al., 2015). Germany is experiencing an ageing of their psychiatrists, with the percentage of physicians younger than 35 years of age decreasing from 26.6% in 1993 to 18% in 2013 (Baumgardt et al., 2015).

Poland experiences a relatively lower equity in the access to family doctors, cardiologists, and oncologists in both geographical and population distribution (Rój, 2020). The most common causes of death in Poland, accounting for more than half of the disease burden, are, however, cancer and cardiovascular diseases (Rój, 2020). This situation points to the need for

a policy aimed at promoting greater equitability within the nation's HRH (Rój, 2020).

Additionally, the European Commission-funded, Brain Drain to Brain Gain initiative, implemented by the WHO Health Workforce Department, discovered evidence that health worker migration patterns were more complex than previously thought, highlighting the need for improved linking and sharing of migration data with employment data (WHO, 2017a). Further, the initiative brought to light the importance of globalised education and training and the great inequity in career opportunities within the health workforce (WHO, 2017a).

The European Commission approximates that by 2020 the health workforce will experience a potential shortage of around 1 million healthcare workers, with expectations to increase to a shortage of 2 million if ancillary professions and long-term care is taken into account with no action taken to address HRH challenges (Buchan & Perfilieva, 2015). EU Member States in 2010 accounted for approximately 17.1 million jobs in the healthcare sector, 8% of all jobs in the region (Buchan & Perfilieva, 2015).

Instead of the current regard of health workforces as a cost, targeted by arbitrary cost reductions, capacity-building should become a key prioritisation in the transition to greater health system sustainability in order to support health workforces, drive a positive change, subsequently and improve effectiveness (Buchan & Perfilieva, 2015).

2.2. Economic Impact

Health systems within the European Union carry out crucial social security functions by mitigating health and financial risks and significantly contributing to social and economic welfare (by preventing and treating disease and covering its associated costs) (Thomson et al., 2009).

Financial challenges have continued to creep up on public and private health systems around the globe to different extents, with no exception for 2020 (Allen, 2019). Factors contributing to this issue include an expanding and ageing population, growing trends in people diagnosed with chronic, long-term ailments, rising labour costs, workforce shortages, costly infrastructure and medical technology investments (exacerbated by the low levels of capital spending throughout the years), and growing calls for a larger ecosystem of services (mental health, long-term, general practitioner, community- and home-based, for example) (Allen, 2019).

Due to the recent introduction of a legislative framework for economic governance, health policies within the European Union have acquired a new macroeconomic dimension (Popescu et al., 2018). The role of states in the provision of health services will likely shrink as a result of the updated reforms, which has an aim of shifting towards a private environment with a competitive market, to avoid the collapse of state systems under the pressures of an ageing population, high budget deficits, and rising expenditures (Popescu et al., 2018).

As a result of mounting cost pressures, Member States have been notified by the Council of the European Union of the challenges they face in securing the financial sustainability of their health systems without compromising

values of equitable access, high-quality healthcare, universal coverage, and solidarity in financing (Thomson et al., 2009). It is worth noting, however, that the economic sustainability and the fiscal sustainability of health systems should not be confused (Thomson et al., 2009). More on the differences of these terms will follow.

Health system design after the 1950s catered towards populations with a life expectancy of 65 to 70 years (Liaropoulos & Goranitis, 2015). Near full employment and a retirement age of 60 to 65 meant that health systems were adequately financed through lifetime earnings and savings, and, further, increasing health expenditure led to welfare gains for everyone (Liaropoulos & Goranitis, 2015).

However, health financing experienced a fundamental shift in core issues during the last half-century (Liaropoulos & Goranitis, 2015). In the 21st century, health science and technology advancements continued to improve quality of life, notably for those who were older, and the average life expectancy of people increased to 80 years (Liaropoulos & Goranitis, 2015). Prolongation of life correlates to increasing health costs, an actuality that democratic societies currently face (Liaropoulos & Goranitis, 2015).

To evaluate how healthcare financing should be faced and by who, the value system and moral fabric of a society would need to be assessed (Liaropoulos & Goranitis, 2015). The question is deeply ideological and political, with other elements such as social involvement, freedom of choice, and personal responsibility playing a role (Liaropoulos & Goranitis, 2015). Discussions centred around health system sustainability often lack vigour on questions surrounding financing (Liaropoulos & Goranitis, 2015).

Historically, Greece covered around 40% of healthcare costs through social insurance funds (Liaropoulos & Goranitis, 2015). Between the years 2009 to 2012, social insurance expenditure in Greece fell by 29.3%, resulting in a rapid decline in quality of care and health system fairness (Liaropoulos & Goranitis, 2015). High unemployment rates of around 27%, due to a fall in gross domestic product (GDP) by 25%, led to employer-employee contributions that were no longer adequate to fund the nation's healthcare (Liaropoulos & Goranitis, 2015). Consequently, Greece faced mounting pressures to reorient its healthcare funding strategies (Liaropoulos & Goranitis, 2015).

2.2.1. Healthcare Spending

Economic sustainability in the context of health systems refers to the growth in health spending as a proportion of GDP (Thomson et al., 2009). The economic sustainability of health systems, or level and growth rate of health spending, is a cause for concern due to the opportunity cost that arises as a result of spending on health (Thomson et al., 2009). Other areas of economic activity, such as education, housing, national defence, and leisure, would receive one Euro less for every Euro that is spent on health (Thomson et al., 2009).

The global financial crisis resulted in decidedly lower rates of health spending growth. However, national and international forecasts suggest that health spending will resume increasing growth in the medium to long-term and lead to possible sustainability challenges (Organisation for Economic Co-operation and Development [OECD], 2015). The European Commission

detected that numerous EU nations, including Austria, the Czech Republic, Germany, Ireland, Finland, France, Malta, Poland, Netherlands, Portugal, Poland, the Slovak Republic, Slovenia, and Spain, were at risk of sustainability challenges due to healthcare spending (OECD, 2015).

Projections by the OECD concluded that healthcare spending across OECD nations (with the condition that governments were able to contain costs) would increase from around 6% of GDP in 2015 to 8.2% by 2030 and 9.5% by 2060 (OECD, 2015). However, if governments are not able to contain costs (and face a "cost-pressure" scenario), healthcare spending is forecasted to increase to 8.8% of GDP by 2030 and 14% of GDP by 2060 (OECD, 2015).

Researchers and policymakers are grappling to comprehend the rising trend of health expenditure in high-income, economically developed OECD nations, with spending having exceeded inflation levels for decades (OECD, 2015). This development is understandable for low- and middle-income OECD nations as advancements towards universal coverage of health services are being made, and unmet needs are met (OECD, 2015). This development of increasing health expenditure in economically developed nations is commonly attributed to four determinants of health expenditure, including new health technologies, rising incomes, changing demography, and institutional characteristics of health systems (OECD, 2015).

As new health technologies are introduced, medical services experience an extension of scope, range, and quality (OECD, 2015). As a result, healthcare costs increase to compensate for the improved (albeit more costly) care of complex illnesses, some of which may have been untreatable prior to the

technological advancements (OECD, 2015). This advancement in technology means that the scope of treatable illnesses also grows, thereby increasing the use of health services on the whole (OECD, 2015). On the other hand, technological advancements could reduce costs as a result of shortened morbidities or less costly treatment inputs (OECD, 2015).

Another significant contributor to rising health expenditure is changing demography and rising incomes (OECD, 2015). The shift towards an ageing population results in increased treatment costs as the elderly are more likely to develop chronic conditions with multiple morbidities (OECD, 2015).

Additionally, rising incomes contribute to increasing costs since although individual healthcare is often considered necessary and therefore income inelastic, populations expect that as countries grow richer, so too does the quality and scope of healthcare (OECD, 2015). Research utilising national level longitudinal data has demonstrated that income elasticities are typically greater than one, as health spending surpasses economic growth (OECD, 2015).

Rising health expenditure has also been attributed to institutional characteristics of health systems (OECD, 2015). Although highly debated, the “Baumol effect” among all health systems puts forward that health service productivity is lower (and price inflation higher) compared to other sectors of the economy that are less labour-intensive (OECD, 2015). Evidence suggests that primary care gatekeepers, for example, and regulations on the general supply of providers, have assisted in curbing costs, while unregulated fee-for-service payment systems have escalated costs (OECD, 2015).

The insufficiency of health system revenue to meet health system obligations presents itself as a critical sustainability problem (Thomson et al., 2009). Once the social cost of health spending exceeds its produced value, health spending is no longer economically sustainable (Thomson et al., 2009). A nation's health system may come to be seen as economically unsustainable if growing healthcare expenditures rise and threaten other valued areas of economic activity, particularly if a nation's economy is static or receding (Thomson et al., 2009).

2.2.2. Public Expenditure

Fiscal sustainability in the context of health systems refers specifically to public expenditure on healthcare (Thomson et al., 2009). Out-of-pocket (OOP) spending in private healthcare markets, for example, is not included in this context (Thomson et al., 2009).

It would be possible for a health system to be economically sustainable yet fiscally unsustainable, such as if public revenue was unable to cover public expenditure (Thomson et al., 2009). Although the fundamental structure of the economic and fiscal sustainability problem is similar, the underlying causes of the problem are different (Thomson et al., 2009).

As mentioned earlier, opportunity costs arise as a result of spending on health. Every Euro of a fixed government budget that is spent on health equates to one less Euro spent on other aspects of government responsibility, such as education and national defence (Thomson et al., 2009).

Although healthcare is deemed extremely valuable by societies, this is not to say that they do not hold other commodities in high regard (Thomson et al., 2009). Once a nation's government is unable or unwilling to generate adequate revenue, or reduce other aspects of government spending, to meet its health system obligations, fiscal sustainability becomes an issue (Thomson et al., 2009).

Although the economic sustainability of health systems within the EU is a worrying issue (especially if the role of private funding is not expanded), fiscal sustainability presents itself as a larger, inherently accounting-based problem exacerbated by poor institutional capacities, prudential fatigue, and unavoidable realities of health system waste generation (Thomson et al., 2009).

Health system sustainability is a challenge, albeit a necessary one, because of the health values that we hold as a society and put forward by the Council of the European Union (universal coverage, solidarity in financing, equity of access, and the provision of high-quality health care) (Thomson et al., 2009). If these values held no support and were cast aside, health system sustainability would hardly constitute a problem (Thomson et al., 2009).

On the one hand, it is argued that to secure health system sustainability, efforts to improve value through health financing system design should be prioritised (Thomson et al., 2009). On the other hand, it is noted that fiscal sustainability is a political problem (Thomson et al., 2009). As such, the issue of fiscal sustainability presents itself as a result of challenges in the ethics of distribution or the "political economy of sharing" (Thomson et al., 2009).

Numerous health systems around the world are struggling to maintain financial sustainability as a result of the current changing and uncertain environment (Allen, 2019). European healthcare services operate on traditional sources of funding that are insufficient and too expensive (Popescu et al., 2018).

In order to improve the distribution of affordable, efficient, and adequate health services to all citizens, health systems within the European Union require extensive reforms (Popescu et al., 2018). Innovations are particularly necessary within the European Union (where a majority are accustomed to free, state-supported health services) to ensure health sustainability (Popescu et al., 2018).

In Germany, 12% of hospitals have declared themselves to be in financial distress (Allen, 2019). Operators are experiencing an increasing trend of insolvency cases, and inpatient cases are declining amongst hospitals for the first time in years (Allen, 2019). In the Netherlands, top clinical hospitals acquired a thin, average profit margin of 1.8% in 2017, with around half of the hospitals currently (or having recently) undergone a major cost revamp (Allen, 2019).

The United Kingdom's NHS experienced a hospital trust deficit of £960 million in 2017-2018 (Allen, 2019). In 2018-2019, this figure improved to £551 million (Allen, 2019). However, this was mostly due to temporary, extra funding, one-off savings, and accounting adjustments (Allen, 2019). All in all, the NHS's overall underlying financial deficit of hospital trusts totalled £4.3

billion in 2017-2018, increasing to £5 billion by the end of the following 2018-2019 year (Allen, 2019).

In order to achieve financial sustainability while continuing to deliver high-quality medical services, health system leaders will most likely need to utilize a balanced variety of support measures (Allen, 2019). These financial support measures may include payment reforms, pricing controls, universal health coverage, public-private partnerships (PPPs), and population health management (PHM) (Allen, 2019).

Changing regulatory landscapes and industry consolidations are also seen as influencing elements (Allen, 2019). For the majority of nations, these financial support measures appear to be capable of bending health system cost curves and improving operational and financial performance in the process of providing affordable, accessible healthcare (Allen, 2019).

2.3. Sustainability Within Health Systems

In addition to addressing current challenges without compromising the ability of those in the future to do so, sustainability in the context of health systems refers to understanding the intricate relationships and synergies between financial sustainability, environmental sustainability, resilient people and communities, and social justice (Pencheon, 2013). Health system sustainability tackles the issue of balancing health system obligations and its ability to meet those obligations continuously (Thomson et al., 2009).

Healthcare systems have continued to meet the growing health needs of societies alongside and as a result of the scientific and technological progressions of the 20th and 21st century (Borgonovi et al., 2018). Numerous

European nations were able to introduce increasingly comprehensive and munificent health protection and health promotion services as a result of these progressions, thereby advancing their welfare systems significantly (Borgonovi et al., 2018).

However, while aiming to improve quality and safety within environmental and financial limits, health systems face an expanding scope of sustainability challenges (Pencheon, 2013). Further exacerbating the problem is the increasing demand for healthcare and the rising cost of technologies (Pencheon, 2013). To successfully and sustainably tackle challenges, healthcare problems require thorough examination at a system level and not as separate issues (Pencheon, 2013).

Health system sustainability requires collaborative efforts in order to ensure the overall wellbeing of its stakeholders (Buffoli et al., 2013). To remain resilient and adaptable and able to continue providing a high standard of service in the face of changing circumstances, health systems should maintain these efforts (Buffoli et al., 2013).

As one of the most trusted segments of society, the healthcare sector carries substantial responsibility. The increased implementation of sustainable practices would provide healthcare institutions with an opportunity to take the initiative and demonstrate leadership within their societies (Institute of Medicine [IOM], 2007). A health system serves as a platform led by relevant leaders where students and citizens, for example, could receive further education on the subject of sustainable healthcare and health promotion (IOM, 2007).

Additionally, and most significantly to some stakeholders, there is the possibility for significant cost reductions within healthcare systems, along with increased efficiency. For healthcare professionals, the main priority of sustainable strategies within health systems almost certainly remains its potential to preserve and support wellbeing, both directly and indirectly (IOM, 2007).

2.3.1. Defining a Sustainable Health System

A health system consists of institutions, hospitals, doctors' offices, and clinics that provide a medical service and consequently handle economic resources granted by the government, communities, provinces, private agencies, and insurance companies when doing so (Osorio-González et al., 2020).

The main function of health systems is to provide high-quality, universal health services while also playing an integral role in the status and stability of national and regional economies through health spending and investments (WHO, 2019). Additionally, through responsible practices in the areas of supply chain activities and employment, health systems are becoming increasingly essential in driving inclusive and sustainable development (WHO, 2019).

The United Kingdom's NHS defines a sustainable health and care system as one that delivers high-quality healthcare within the available environmental, social, and economic resources, providing added value for taxpayers and improving public health within the limits of diminishing natural and financial resources (National Health Service [NHS], 2018).

Healthcare systems vary significantly from one nation to the next, even regionally within a single state (Prowle & Harradine, 2015). England, Scotland, Wales, and Northern Ireland, for example, are all within and a part of the United Kingdom yet experience variations within their healthcare systems (Prowle & Harradine, 2015).

There are different elements to the overarching design of health systems, including the:

- nature, size, roles, number, and location of the various healthcare institutions (such as hospitals) included in the health system,
- size and role of both the private and public sectors in the health system,
- balance between preventative services (such as health promotion, intended to prevent people from becoming sick in the first place), acute care, and longer-term services,
- balance between primary, secondary, and tertiary care,
- balance between various clinical specialities,
- relationship between healthcare and social care,
- administrative framework and mechanisms for planning, running, and managing healthcare services, including the extent of centralised and delegated service provisions,
- degree of specialisation amid the various institutions,
- regulatory procedures in operation to maintain standards, and
- extent of market competition between institutions in the health system (Prowle & Harradine, 2015).

There are currently a few classifications of healthcare systems according to institution type, funding source, or population to which the medical service is aimed (Osorio-González et al., 2020).

Table 1: Main Health Models Used Around the World

Health model	Characteristics	Countries
Beveridge	• Medical care is offered to all citizens • This model is financed by the government through tax payments	• United Kingdom • Spain • New Zealand
Bismarck	• Applies an insurance system that is financed by employers and employees through payroll deductions • Insurance plans in this model are not profitable since they do not include all citizens • A harmful aspect of this model is that hospitals and doctors are usually private	• Germany • France • Belgium • The Netherlands • Japan • United States • Switzerland
National health insurance or Tommy Douglas	• A mixed model which applies characteristics of both the Beveridge and Bismarck model • Providers are from the private sector • Financed by insurance payments administered from the government through citizen's payments of taxes and premiums • These types of programs are usually less expensive	• Canada
Out-of-pocket	• This model is used in countries with precarious economies which disable the government from providing any form of medical coverage • Citizens who are able to afford medical care may receive it	• Africa • India • China • South America

From “Sustainable Healthcare Systems,” by C.S. Osorio-González, K. Hegde, S. K. Brar, A. Avalos-Ramírez, and R.Y. Surampalli, 2020, *Sustainability: Fundamentals and Applications*, p. 377.

In summary, health systems are funded through numerous approaches. The WHO puts forward that there are five conventional primary methods of healthcare funding, including 1) general taxation, 2) social health insurance, 3) private or voluntary health insurance, 4) out-of-pocket payments, and 5) donations and charities (Prowle & Harradine, 2015). Health systems are rarely funded through one approach alone, but rather a combination of approaches (Prowle & Harradine, 2015).

Table 2: Configuration of Healthcare Systems in Relation to Financing

		Configuration	
		Public	Private
Financing	Public	A	D
	Private	C	B

From “Sustainable Health Care Systems: An International Study,” by M. J. Prowle and D. Harradine, 2015, *American Journal of Medical Research*, *2*(2), p. 190.

The United Kingdom’s NHS, for example, is configured around four financial segments (refer to Table 2 above) (Prowle & Harradine, 2015). Segment A involves services that are provided by public sector agencies and financed through public funds (such as taxes) (Prowle & Harradine, 2015). Hospital services in England provided through the NHS predominantly fall into this

segment (Prowle & Harradine, 2015). Segment B involves services provided and financed through private-sector agencies (by means of private health insurance) (Prowle & Harradine, 2015). Segment C involves services provided by public agencies but financed through private sources (such as private health insurance) (Prowle & Harradine, 2015). In England, certain NHS hospitals provide private health units which operate in conjunction with publicly financed services (patients receive privately financed healthcare while being admitted to a public hospital) (Prowle & Harradine, 2015). Segment D involves services that are provided by private-sector agencies but financed through public funds (Prowle & Harradine, 2015). Under existing treatment programmes, certain patients in England may opt to receive healthcare services in private hospitals (at the expense of taxpayers) (Prowle & Harradine, 2015).

Sustainability and sustainable development, interchangeably used terms, could be defined as “a capacity to meet different needs such as food, energy, social and economic welfare, without compromising the ability to meet the same needs of the following generations” (Osorio-González et al., 2020). The aim of sustainability within health systems is to improve healthcare through dynamic processes, primarily with a balanced approach to social, environmental, and economic development (Osorio-González et al., 2020). This process is reflected in the evolution of healthcare systems in regard to patient safety, access to service, and quality of service (Osorio-González et al., 2020).

Although the concept of sustainability and its practices has continued to expand within the health industry, all health systems have experienced struggles in the last decade due to their lack of sustainability, primarily in

terms of service coverage, costs, and quality maintenance (Osorio-González et al., 2020). This circumstance has materialised due to the increase in population, noticeably the older population (those above 65 years of age), as well as the development of new technologies to satisfy existing demands (Osorio-González et al., 2020).

The consequences of the recent economic crisis and the effects of the COVID-19 pandemic have further aggravated the issues of equity and access in healthcare systems, even in developed nations with great technological and economic advances (Osorio-González et al., 2020).

Due to the multi-faceted nature of healthcare systems, the conventional pillars of sustainable development (economic, social, and environmental) are occasionally not mentioned literally, as these terms could be considered too broad (González et al., 2020). For the purpose of this thesis, however, the sustainability of health systems will be analysed in regard to the three pillars of sustainability.

Environmental sustainability and the mitigation of environmental pollution within health systems are, for the most part, practised in operation (Marimuthu and Paulose, 2016). Examples of these pollution prevention (and ultimately cost-saving) practices include increased water efficiency, minimisation of hazardous chemical usage, elimination of mercury, recycling, and mitigation of sanitary waste toxicity (Osorio-González et al., 2020). Additionally, environmental sustainability has expanded within health systems to include sustainable design and construction techniques (Osorio-González et al., 2020).

The objective of social sustainability within health systems is to ensure the inclusion and equity of all people within the various systems (Capolongo et al., 2016). Social sustainability practices would, for example, work to promote measures that would permit access to healthcare services for all, regardless of race, nationality, colour, and economic class (Capolongo et al., 2016). Society also plays a committed role in supporting social sustainability within health systems through volunteer work, social labour, and disseminating and participating in local resilience activities (Osorio-González et al., 2020).

Another dimension of health system sustainability involves economic sustainability (or fiscal sustainability). Economic sustainability in the context of health systems is defined by the European Commission as the ability to maintain current policies without giving rise to increasing debt as a share of GDP (Popescu et al., 2018).

Sustainable health systems maintain themselves through constant adaptation in line with their turbulent economic, social, and demographic environments, ensuring that finite resources (financial, physical, and human) are used responsibly and efficiently so as to achieve the constant maintenance and improvement of population and individual health (Popescu et al., 2018).

Further, a sustainable health system requires the presence of three key elements: adaptability (in order to remain viable and adequately conform to new socio-economic changes, demographic transitions, novel illnesses, scientific discoveries, and dynamic technologies), accessibility for every individual, and mutual acceptance between medical employees and patients (Popescu et al., 2018). Sustainability within health systems could be viewed

as a constant and moving goal, rather than a fixed target, with emphasis placed on adaptability needed to face the pivotal challenges faced by society (Popescu et al., 2018).

2.3.2. Benefits of Sustainability Within Health Systems

Several authors claim that sustainability initiatives that are worth sustaining are those proven to be effective (Fleiszer et al., 2015). This means that a key element of sustainability should be continued benefits, irrespective of certain activities or the formats in which they are delivered (Fleiszer et al., 2015). Although continued benefits were claimed as crucial to the concept of sustainability in health systems, it was not always clear how the notion of benefits was specifically defined (Fleiszer et al., 2015).

One interpretation concluded that benefits were positive (quantifiable) results which reflected the achievements of objectives (Fleiszer et al., 2015). Another perspective of benefits concluded that the perception of achieving benefits was as important as actually achieving benefits in the shift to sustainability, irrespective of whether the benefits were formally documented (Fleiszer et al., 2015). Necessary characteristics of effective health system sustainability would include continued attainment of goals and resolution to problems, irrespective of the original programme (Fleiszer et al., 2015).

The potential benefits of health system sustainability are becoming increasingly apparent as more health systems incorporate sustainable development into their core operations (WHO, 2017), notably the four health system functions: service delivery, resource generation, stewardship, and financing (WHO, 2016).

The main aims of implementing sustainability reforms in health systems is to reduce the externalities caused by health system activity, strengthen the elements of health systems that promote a positive impact, and improve the overall resilience of health systems to change (WHO, 2016).

Table 3: Opportunities for Increased Sustainability Within the Four Health System Areas (Service Delivery, Resource Generation, Stewardship, and Financing)

Service delivery	Resource generation	Stewardship	Financing
• Digital health/eHealth • Using alternative medical devices • Assessing treatment options • Service reconfiguration • Waste management strategies • Health protection and promotion activities	• Facilities design and operation • Workforce education • Pharmaceutical manufacturing • Staff engagement and commitment	• Intersectoral advocacy	• Procurement processes • Access to alternative sources of income • Reputational benefits • Responsible investment

From *Towards Environmentally Sustainable Health Systems in Europe. A Review of the Evidence*, World Health Organisation, 2016.

2.3.2.1. Environmental Benefits

Evidence supports the reality that health systems have a detrimental impact on the environment (WHO, 2016). There are, however, situations in which sustainably managed health systems have shown to provide a positive effect on the environment, such as through active health promotion and health protection activities (WHO, 2016). Additionally, reduction of energy and other resource consumption through increased efficiency naturally leads to a decrease in costs. This opportunity for cost-saving exists within the four health system functions (service delivery, resource generation, stewardship, and financing) (WHO, 2016).

Regional communities have been shown to experience improved wellbeing through increased sustainability efforts by healthcare facilities, most notably in terms of improved waste management and reduced emissions (WHO, 2016). Further, additional evidence has supported that efforts in enhancing environmental quality, through urban greening and constrained air pollution, for example, and behaviour change methods, such as shifts to low-carbon diets and active transport, have greatly improved public health (WHO, 2016).

Additionally, studies have shown that there is significant room for improvement in terms of access to health services and quality of care (WHO, 2016). Patients could benefit from a higher quality of care through lighting changes in inpatient wards, for example, and easier access to health services with the successful implementation of eHealth technologies, which would significantly reduce the need to travel (WHO, 2016).

In terms of workforce benefits, the healthcare sector, similarly to other sectors, would likely also experience increased employee morale and

recruitment, improved levels of organizational commitment, and enhanced retention as a result of cultivating environmental sustainability (WHO, 2016).

Climate resilience may prove to be one of the most valuable potential benefits to be gained from a sustainable health system. According to the WHO, a climate-resilient healthcare system is one that could “anticipate, respond to, cope with, recover from and adapt to climate-related shocks and stress, so as to bring sustained improvements in population health, despite an unstable climate” (WHO, 2015). These potential benefits could include reduced population exposure to climate change impacts, preparedness for extreme weather occurrences, and the protection of future supply chains on which health systems strongly depend (WHO, 2016).

2.3.2.2. Social Benefits

Net contributions by health systems to social (and economic) progress manifests as a result of their contributions to sustainable development and equitable economic growth (WHO, 2019). These contributions include increased employment opportunities, implementation of inclusive employment policies, improved skills base in regional and local labour markets, targeted investments in deprived or economically low-output areas, increased use of micro, small, and medium-sized enterprises (MSMEs) during procurement and purchasing, and improved social cohesion in disadvantaged communities (WHO, 2019).

Staff empowerment and willingness to accept greater responsibility for sustainability is encouraged as a result of providing departments and teams with comprehensive information on their use of resources and subsequent environmental impact (Naylor & Appleby, 2012). Placing power and

responsibility for sustainability in the hands of the workforce, combined with implementing relevant changes to managerial practices and disaggregated data collection processes (such as through electricity sub-metering), has the benefits of promoting significant staff engagement (Naylor & Appleby, 2012).

2.3.2.3. Economic Benefits

The economic and social benefits of health system sustainability are often overlooked and misunderstood within mainstream development processes and investment decisions at local, national, and European levels (WHO, 2019). Dominant discussions have been centred around health system costs and, as a result, public expenditure on health is being challenged within many European nations, with risk of decline (WHO, 2019).

Sustainable reforms within health systems will differ in terms of their return on investment and the timeframe during which this return will occur (Naylor & Appleby, 2012). A publication by the NHS Sustainable Development Unit (SDU) highlighting a series of "Marginal Abatement Cost Curves", whereby carbon savings were plotted against financial investment (for a series of carbon reduction operations), demonstrated that certain operations would offer a rapid return on investment within two to three years (Naylor & Appleby, 2012). If 29 of these operations were implemented within the NHS in England, approximately £180 million and over 800,000 tonnes of carbon dioxide could be saved (Naylor & Appleby, 2012).

In terms of financial returns on investments, the reforms that offer the greatest returns include reduction of drug wastage, reduction of business travel through teleconferencing, and installation of combined power and heat generators in acute trusts (Naylor & Appleby, 2012). The estimates of

potential savings may even be greater, as the approximations do not indicate the limit of what could be achieved through the implementation of additional sustainability reforms (Naylor & Appleby, 2012). Fundamental shifts in how, where, and what care is provided could lead to significant carbon savings and cost reductions (Naylor & Appleby, 2012).

Numerous case studies have shown that theoretical cost savings as a result of increased sustainability within health systems are successfully achievable in practice (Naylor & Appleby, 2012). Several local authorities in England have cited cost reductions as a primary driver for the implementation of sustainable reforms within health systems (Naylor & Appleby, 2012). Reforms implemented by leading institutions such as University College London Hospitals and Bristol City London have yielded speedy returns (Naylor & Appleby, 2012).

Additionally, health systems are incurring direct financial costs as a result of environmental policy tools, such as the English government's Carbon Reduction Commitment (CRC) Energy Efficiency Scheme, which requires most NHS trusts and local authorities to purchase mandatory carbon credits (Naylor & Appleby, 2012). These credits are costing the NHS in England approximately £50 million a year, with expectations to increase as carbon prices rise and other policy tools are developed (Naylor & Appleby, 2012). Consequently, the reduction of health systems' carbon footprints would lead to a reduction of incurred costs (Naylor & Appleby, 2012).

2.3.3. Barriers to Sustainability Within Health Systems

Barriers to health sustainability have the potential to hinder the successful adoption and implementation of sustainable practices at a systemic level (WHO, 2017). Although depending on the situation of each nation, barriers to health system sustainability typically include weak governance, inadequate regulatory frameworks, and weak enforcement of existing frameworks (WHO, 2017).

2.3.3.1. Ageing Population

The number of persons over 60 years of age is expected to double by 2050, increasing from 901 million to approximately 2.1 billion (Pereno & Eriksson, 2020). Subsequently, as the share of older persons in a population grows, the share of working-age people (who fund the bulk of healthcare through their financial contributions) diminishes, leading to levels of healthcare demand that exceeds the capacity of health systems (Thomson et al., 2009).

Pressure on health systems increase as demand for services, care, and technologies required to treat non-communicable diseases and chronic conditions associated with old age increases (Pereno & Eriksson, 2020). There has been a progressive shift towards chronic care within the United States and European Union, as chronic non-communicable diseases account for 68% of the world's deaths and 70% of healthcare spending (Pereno & Eriksson, 2020).

2.3.3.2. Technological Advancements

Technological advancements in healthcare are cost-increasing due to the increased ability to treat what was untreatable previously (Thomson et al.,

2009). As newer technologies replace older, more expensive alternatives, a rebound effect occurs whereby utility, and subsequently cost, increases (Thomson et al., 2009). This cost problem is compounded if older persons are the principal beneficiaries of the technological advancements (Thomson et al., 2009).

Additionally, consumers typically expect to receive newer, more expensive diagnostic procedures (and medications) as they become available; as a result of this demand for technological advancements and treatments, healthcare costs increase (Coiera & Hovenga, 2007). Previous evidence has pointed to the overuse of these inappropriate or wasteful healthcare interventions, and the under-utilisation of cost-effective interventions (leading to significant national opportunity cost), as a result of poor decision-making (Coiera & Hovenga, 2007).

2.3.3.3. Lack of Awareness Among Health Workers

Lack of knowledge and awareness among health workers is a significant barrier to the successful implementation of sustainable practices within health systems, thereby inhibiting the goal of fostering sustainability (WHO, 2016). A large number of case studies and surveys of both low- and high-income nations in a range of settings corroborated the lack of awareness among health workers, most notably in terms of waste disposal and segregation, energy conservation, and water use (WHO, 2016).

More than 50% of all mercury waste in Ireland is disposed of incorrectly; surveys of healthcare professionals in Ireland (and Croatia) revealed a

limited understanding among nursing staff of the risks posed by mercury toxicity (WHO, 2016).

However, psychological research shows that barriers to sustainability within health systems at an individual level are not solely a question of knowledge and awareness (WHO, 2016). One of the studies observed various psychological barriers limiting engagement with sustainability in healthcare settings, including denial of the problem (as a coping strategy), “moral offset” (believing that one is doing enough good by being a doctor/nurse), and diffusion of responsibility (believing that someone else will solve the problem) (WHO, 2016). In essence, the research revealed the disempowering nature of hospital environments which, consequently, led to environmental “numbness” among health workers (WHO, 2016).

Additionally, research of the potential psychological barriers of healthcare workers in regard to sustainability emphasised the stark contrasts between the reactive and fast-paced culture of healthcare environments (where priority is given to immediate concerns) and the longer-term actions needed to achieve sustainability as a key element to note (WHO, 2016). Psychological barriers within the health system environment needs to be addressed, as research in other sectors has shown that sustainability requires employee engagement at all levels in order to successfully embed a concern for sustainability within an organisation (WHO, 2016).

2.3.3.4. Organisational Barriers

Organisational elements could potentially act as a barrier to health system sustainability, creating limits for individuals to act on environmental considerations (WHO, 2016). Evidence has demonstrated that numerous

hospitals use inappropriate containers for medical waste collection, thereby limiting the potential to implement effective waste management strategies as current waste collection measures do not meet segregation and disposal guidelines (WHO, 2016). Although this problem is more common in lower-income nations, waste management standards in high-income nations continue to fall short of regulatory expectations (WHO, 2016). An audit of 16 hospitals in the United Kingdom revealed that medical waste carts and areas dedicated to medical waste storage were considered to be “in a poor state of repair” (WHO, 2016).

Health system institutions are often slow to respond to changes in requirements and regulations (WHO, 2016). To illustrate, the growing trend of at-home patient care has led to greater responsibilities by municipal authorities to ensure that medical waste at domestic properties is disposed of appropriately (WHO, 2016). However, an audit of local authorities in the United Kingdom has demonstrated that very few have responded adequately to these growing responsibilities (WHO, 2016).

2.3.3.5. Weak Governance and Lack of Regulatory Frameworks

Weak governance at the national level, lack of appropriate regulatory frameworks, and poor enforcement of existing legislation and regulations would undoubtedly act as significant barriers to achieving health system sustainability (WHO, 2016). In several European countries, there is prevalent institutional amnesia and inertia when addressing healthcare obstacles (Momete, 2016). The varying levels of involvement and differing interests of political parties has led to constantly changing public health policies (Momete, 2016).

2.3.4. Pathways to Sustainability Within Health Systems

The pathway to health system sustainability involves addressing various key factors, such as long-term vision and innovation, quality, disease prevention and health promotion, institutionalisation of environmental concerns, and institutional accountability and individual responsibility (Fischer, 2015).

2.3.4.1. Long-Term Vision and Innovation

Firstly, in order to remain sustainable in the long run, the financial costs of a health system would need to be kept under control (Fischer, 2015). Although policymakers and researchers mostly disagree on an approach to ensure overall economic sustainability, there is some agreement on the need for change in regard to provider and patient behaviour, as well as increased investment in health promotion activities (Fischer, 2015).

Additionally, in order to provide a maximum value for money, health providers should be urged to create the appropriate incentives (Fischer, 2015). For example, spiralling pharmaceutical costs requires some form of control, whether that be through price-controls, bulk buying, or education campaigns aimed at the qualified reduction of customer demand (Fischer, 2015). Key issues involving the implementation of cost-control management procedures and revision of existing approaches would also need to be addressed (Fischer, 2015).

The utilisation of generic medication, for example, is a key instrument to sustaining health systems and controlling pharmaceutical expenditure, providing similar treatments to patients and payers at a lower cost (Simoens,

2010). As a result, budgets are liberated for the innovation of new medications (Simoens, 2010). The use of generic medication has previously been encouraged by varying methods across Europe; Belgium applied a reference pricing system, Portugal implemented higher reimbursement rates for generic medication, Poland demonstrated favourable attitudes by physicians towards generic medication, medical students in the United Kingdom were taught to prescribe medication by International Non-Proprietary Name (INN), Germany experimented with various physician budgets, Denmark implemented generic substitution by pharmacists, and, similarly, France allowed pharmacists to substitute originator medication with generic versions (Simoens, 2010). Further implementing cohesive, long-term supply- and demand-side policy measures to improve key policy drivers that strengthen generic medication markets within European countries could assist in improving the sustainability of its generic medication markets and overall health systems (Simoens, 2010).

Secondly, policymakers require the application of a strategic perspective in order to ensure health system sustainability. Incremental decision-making limits the possibility of achieving long-term, strategic deliberations needed for health system sustainability (Fischer, 2015). Instead, long-term planning should be implemented (Fischer, 2015).

Transient political interests should be avoided for the good of public health and instead, characterised by continuity, irrespective of the current political party in office (Momete, 2016). As teams and ministries experience shifts and changes, health strategies should remain on track (Momete, 2016). Additionally, in order to mitigate the differing interests and involvement of various political parties, public health policy design would benefit from

management by neutral experts (Momete, 2016). Further, to successfully implement a strategic management approach, stakeholders should undertake a realistic analysis of the current situation, followed by an application of clear, long-term goals and a comprehensive plan of action on how to achieve these goals (Fischer, 2015).

The overall decline in healthcare emissions related to direct energy usage within Austria, for example, is strongly attributed to changes within the nation's health policy (Weisz et al., 2020). In an effort to reduce costs, the Austrian health policy pursued an objective to shift its highly hospital-centred health system towards ambulatory healthcare provision and residential long-term care (Weisz et al., 2020).

Basic and lasting reforms are key to balancing social and financial imperatives, as opposed to patchwork repairs and disorganised direction (Fischer, 2015). Additionally, societal externalities and trade-offs should be communicated transparently and clearly during discussions (Fischer, 2015). Further, to successfully achieve sustainability, health systems would need to become sufficiently adaptive and able to react to changes to inputs and outputs of the system (Fischer, 2015). This could be achieved through unison in regard to healthcare goals as well as participative, sustained deliberations of healthcare reforms across party lines (Fischer, 2015).

Appropriate measures may be recommended once stakeholder data (patients, healthcare providers, families, payers) is collected and analysed by neutral national, regional, or European institutions (Momete, 2016). In order to tackle future hurdles, health system stakeholders should collaborate with the united aim of sustainable reformation and preparation (Momete,

2016). Additionally, neutral institutions could provide data to researchers, acting as an open source of information (Momete, 2016). These actions, along with a common European health policy and consolidated monitoring and control of the European healthcare system, would assist in the mitigation of healthcare inequalities prevalent among European Union member states and overall improvement of the healthcare act (Momete, 2016).

Thirdly, health system sustainability depends significantly on the maximisation of system innovativeness (notably scientific and technological innovativeness), as these contribute to the improvement of healthcare services, development of effective pharmaceuticals, and reduction of administrative barriers (Fischer, 2015). The pace for innovation in healthcare delivery varies greatly among European Union member states, however (Momete, 2016).

In order to remain competitive in the long run, health systems would likely require sustained innovations (Fischer, 2015). This means that the search for innovative funding models and subsequent reforms are unavoidable, despite little consensus on the issue (Fischer, 2015). Possible approaches such as strengthening of the private sector, separation of long-term care and high-cost medical care, or user charges, would need to be evaluated based on the ability to keep costs as low as possible without added detriment to social cohesion (Fischer, 2015).

2.3.4.2. Quality

The quality of a health system is a key determinant of its sustainability, as a lack of quality would lead to higher costs and decreased acceptance by society in the long-term (Fischer, 2015). Elements of health system quality

may include effectiveness, responsiveness, patient-centeredness, acceptability, care environment and amenities, continuity, governance, and safety (Fischer, 2015).

The importance of investing in health-related information and communication technologies has only grown (Fischer, 2015). Sophisticated technology should be standard within all healthcare facilities and incorporated in line with conventional practices in order to allow for the effective analysis of (big) data and assessment of its impact on patient care (Fischer, 2015). Further, unwarranted variations within healthcare and subsequent over-treatment or under-treatment should be reduced (Fischer, 2015).

The overall distribution of healthcare, services, and costs should be carefully monitored by relevant governing bodies to ensure inequalities are addressed (Fischer, 2015). Examples of approaches to tackling inequalities include region-based targets, re-allocation of resources in regions with lower utilisation rates, and implementation of payment reforms in areas with high suspicions of service overuse (Fischer, 2015).

Equitability in a sustainable health system also refers to accessibility, ensuring that all patients will be treated according to their needs with the guaranteed local supplies (Fischer, 2015). The population also perceives a greater quality of health system in those with reduced waiting times and non-discrimination of minorities (such as ethnic minorities, immigrants, the elderly, and those with special needs) (Fischer, 2015).

2.3.4.3. Disease Prevention and Health Promotion

A vital element to health system sustainability lies in prevention and wellness programmes, most notably within primary healthcare facilities (Fischer, 2015). Prevention and promotion activities contribute significantly to improved outcomes for less money within healthcare systems as problems are addressed at earlier stages with increased prevention effectiveness (Fischer, 2015). In essence, health system sustainability would include the support of strong primary care facilities that allow for easily accessible, patient-centred, and comprehensive services (Fischer, 2015).

Chronic disease prevention is another crucial objective within sustainable health systems, as a large majority of primary care visits are attributed to chronic diseases (Fischer, 2015). Patients with chronic illnesses have a greater risk of developing an additional chronic disease (Fischer, 2015). As such, effective chronic disease prevention within sustainable healthcare systems should involve minimised waiting times and high-quality care and solutions for patients diagnosed with or at risk of developing chronic diseases (Fischer, 2015).

HRH plays an integral role in the effective implementation of prevention and health promotion programmes (Fischer, 2015). Providing sustained, high-quality services to patients requires a high level of staff commitment and morale (Fischer, 2015). Inadequate workforces and work overload are common in the health sector, often leading to decreased staff morale, mental illnesses, and burn-out (Fischer, 2015). These key determinants of clinical workforces have been studied amongst healthcare professionals, with results showing a severe negative impact (Fischer, 2015).

Sustainable health systems would need to provide a thriving environment for its workforce, with working hours restricted to reasonable and responsible numbers and fair financial rewards offered for services delivered (Fischer, 2015). Training programmes and further education has been proven to effectively improve staff knowledge and behaviours (such as compliance with waste management regulations) among numerous countries, including the United Kingdom, Spain, Turkey, and Portugal (WHO, 2016).

2.3.4.4. Institutionalisation of Environmental Concerns

As health systems are open systems with numerous interdependencies and interlinkages, it is vital to also take into account elements outside of the health system (Fischer, 2015). As environmental, socio-economic, and cultural conditions shape human health, the importance of indirect prevention and holistic perspectives are made clear (Fischer, 2015).

Health systems should prioritise the reduction of its environmental detriment and consumption of natural resources through the development and implementation of effective environmental waste reduction treatments (Fischer, 2015). A striking example of such an opportunity involves the reduction of pharmaceuticals (Fischer, 2015). Each stakeholder in a health system is able to contribute to increased consciousness when dealing with pharmaceuticals, whether that be through political actions (e.g., environmental objectives), actions to change patient behaviour (e.g., prescription options that limit drug-use or introduction of co-payments), or communication measures (e.g., raising awareness among professional stakeholders) (Fischer, 2015).

Implementing a specific climate strategy for the healthcare sector, such as the United Kingdom's NHS has done, is a vital course of action in the transition to greater health system sustainability (Weisz et al., 2020). In ascending order of severity, areas that require intervention in the reduction of carbon footprint and transition to greater health system sustainability include direct energy utilisation, product alternatives, (in)efficiencies in the healthcare system (covering pharmaceutical issues as well), medical treatments, national healthcare provision planning, and promotion of human and planetary health (Weisz et al., 2020).

In order for hospitals' climate mitigation strategies to demonstrate effectiveness, the scope should expand to cover core medical areas (Weisz et al., 2020). Pathways include avoidance of overconsumption, ecological procurement (opting for low carbon product alternatives), avoidance of misallocation in hospitals, and reducing unnecessary hospital stays (Weisz et al., 2020).

Relying solely on external factors outside of the health system, such as the decarbonisation of energy systems, to mitigate climate change will become increasingly difficult once the cheapest and less controversial options to improve carbon efficiency (within energy sectors and along supply chains) are exhausted (Weisz et al., 2020). Aside from this, increasingly tighter policies would be needed in order to achieve further emission reductions (Weisz et al., 2020). Further contributing to the growing demand for healthcare (and potentially neutralising any progress in greenhouse gas efficiency achieved outside of the health system) are factors such as technological progress, ageing populations, increasing number of chronic non-communicable diseases, and the escalating effects of climate change

on human health (Weisz et al., 2020). As such, climate change mitigation efforts need to prevail not only outside of but, more importantly, within health systems (Weisz et al., 2020).

Further, renewable energy sources should be the primary energy source within medical settings, with efficient use of water and energy consumption remaining a top priority (Fischer, 2015). The issue is not about eliminating non-renewable resources entirely but rather the conscious usage of such resources (Fischer, 2015). In 2014, the Austrian health carbon footprint totalled 6.8 million tons of CO2, indicating a 14% decline since 2005 (Weisz et al., 2020). This decline is attributable to the rising shares of renewables within the Austrian energy sector, with supportive assessments of the carbon emissions from energy use by Austrian healthcare providers validating this finding (Weisz et al., 2020).

Additionally, the topic of single-use disposables within healthcare is highly debated, with opposers making a case for the implementation of effective take-back systems and the development of reusable alternatives (without affecting patient health) (Fischer, 2015). The goal is to develop a solution for the increasing and unnecessary use of single-use disposables (Fischer, 2015).

Importantly, workforces within health systems should ideally be educated on the topic of environmental preservation (Fischer, 2015). Healthcare communities demonstrate a lack of awareness of the impact of health systems and their detrimental effects on the environment and, subsequently, human health (Sherman et al., 2020).

In summary, the interdependence of social and natural environments in regard to healthcare needs to be acknowledged and respected (Fischer, 2015). This awareness should then be appropriately translated into health policymaking (Fischer, 2015).

2.3.4.5. Institutional Accountability and Individual Responsibility

The question of accountability in the context of sustainable health systems is one of great importance as it precedes the following: high acceptance by the population, societal transformation and investment decisions, willingness to allocate resources, and long-term stability of the system as a whole (Fischer, 2015). To stabilise and sustain a health system, its population would need to reflect on what they are required to sacrifice for it (Fischer, 2015).

As health systems are publicly funded, it remains imperative that the allocation of funds, investments, and extent of responsibility should be made clear in order to garner the acceptance of its population (Fischer, 2015). As such, a sustainable health system is one that promotes transparency and clear communication in terms of distribution and competencies (Fischer, 2015).

Since higher healthcare expenditure does not directly relate to greater healthcare outcomes, the movement towards increased accountability and transparency could encourage increased efficiency as resources are shifted to areas of the health system that are recognised as more urgent, and inefficiencies in the system are brought to light (Fischer, 2015).

Accountability also signifies the importance of involving numerous stakeholders in the decision-making process (Fischer, 2015). Stakeholder participation is key in the movement towards sustainable development, both in terms of decision-making as well as permanent discussions within society in regard to common aims for future development (Fischer, 2015). As societies are required to accept future trade-offs in the advancements of health system sustainability, it is necessary to acquire and incorporate population support, as this will mobilise support for the required changes that need to be made by all healthcare stakeholders within the system (Fischer, 2015).

Patient empowerment, in addition, encourages the notion of taking ownership over individual health; a principle that is based on liberal political ideas and observations that well-informed patients have increasingly higher demands for complex information and less dependency on professional gatekeepers as a result of advancements in information and communication technologies (Fischer, 2015).

It is possible to promote patient empowerment by providing direct information in addition to conveying the importance of accepting personal responsibility for individual health (Fischer, 2015). This does not equate to the privatisation of entire health systems but, rather, it points to the importance of patient maturity and commitment in accepting responsibility for individual health (partly and without the social framework) in the shift towards health system sustainability (Fischer, 2015).

3. Methodology

The following section will detail the methods used to identify, select, analyse, and evaluate information while investigating the research question, “Have sustainable health systems met their potential benefits?” in assessing whether, and to what extent, a sustainable approach to healthcare has actualised potential benefits.

3.1. Research Approach

3.1.1. Unstructured Interview

This research paper applied an open-ended, asynchronous, in-depth email interview approach with the aim of retrieving expert opinions on topics relating to sustainable health systems in order to add to this paper’s comprehensive study and understanding of sustainability within health systems and its potential benefits. Building on the understanding of health system sustainability also benefited the case study analysis of this research paper and the subsequent evaluation and conclusion of overall findings.

This asynchronous interview approach entailed ethical advantages in terms of participant control over time spent on the interview, comfort in discontinuing the study, and decreased power differential, as well as unlimited time constraints allowing for relationship building, clarification of data, the pursuit of additional discoveries, and confirmation of participants perspective and accuracy in describing phenomena (Hawkins, 2018). Through back-and-forth, iterative exchanges, participants are able to reflect on their answers before committing to a response, potentially leading to thoughtful, relevant, and rich data as a result of well-formed and reflective responses (Hawkins, 2018).

Dr Willi Haas was identified as a potentially valuable interview partner when his (and co-authors') academic publications were discovered, reviewed, and cited throughout the compilation of this paper's literature review. Dr Haas was approached to participate in this research paper's in-depth interview due to this breadth of knowledge and experience in the field of sustainable healthcare and its literature. As a result of his participation, Dr Haas was able to offer and expand on his literature for the exclusive purposes of this research paper and its aims. Additionally, Dr Haas was able to contribute his insights into this research paper's case study, offering his expert opinions and assisting in the analysis and evaluation of the situation.

The interview design followed an unstructured, open-ended approach, allowing the participant to offer as much detailed information as they wished and providing opportunities for follow-up probing questions (Turner, 2010). The flexible, open-ended design of the interview enabled the participant to fully express their experiences and viewpoints, allowing great potential for gaining detailed, in-depth insights into the subjects at hand.

However, the design of this research's interview approach is not without its potential limitations. As open-ended interviews provide rich and thick qualitative data, it was possibly more difficult to reflect an overall perspective of the participant's responses fully and accurately (Turner, 2010). On the other hand, this greatly reduces researcher biases within the study (Turner, 2010).

Conducting an interview through email has the significant disadvantage of lacking verbal and nonverbal cues (Hunt & McHale, 2007). As the narrative

of this interview was to expand on the participant's ideas, opinions and published literature on the subject matter, verbal and nonverbal cues were not necessarily required to demonstrate deficits in the narrative (Hunt & Mchale, 2007). Furthermore, the use of email communication reduced the risk to both interviewer and interviewee stemming from the prevailing COVID-19 crisis.

3.1.2. Case Study

In order to evaluate whether health systems have experienced the potential benefits of sustainable reforms, this research paper investigated data through a case study approach: an empirical inquiry that offers in-depth, multi-faceted analyses of issues, events, or contemporary phenomena within its real-life context (Crowe et al., 2011), particularly in situations where the boundaries between phenomenon and context are not clear (Yin, 1994).

Along with the object of a study, case study research allows for the complete incorporation of a phenomenon's context (Steenhuis & Bruijn, 2006). This holistic approach is especially beneficial in the context of healthcare institutions and their place in the health system. It could be prudent to assume that the research of healthcare institutions should not be isolated from the greater context of health systems and other dependent practices and theories.

In comparison to another mode of research, such as survey research, a case study approach could potentially provide further concrete and objective results, especially in the circumstances of this thesis, due to its observations of reality and not necessarily people's perceptions of reality (Steenhuis & Bruijn, 2006). Further, as case studies are often used to explain, describe,

or explore phenomena within the everyday contexts in which they occur, this approach would prove extremely valuable when analysing and understanding the causal links and pathways stemming from further development and implementation of new reforms (Crowe et al., 2011).

As the aim of this research paper was to address a practical problem in an emerging situation, a case study approach was deemed suitable due to its preliminary, insightful, and exploratory nature into research areas where existing theory may be limited (Eisenhardt, 1989). The recent emergence of sustainable healthcare and subsequent limitations of previous hypotheses and bodies of work also lent to the suitability of an in-depth, limited-scope study (Yin, 1994).

The study design of this research paper's case study approach is as follows: a mixed-methods, multi-site, longitudinal case study. The case involved England's Manchester University NHS Foundation Trust, consisting of nine hospitals and 20,000 employees serving 2,000,000 patients annually, which recently implemented sustainable reforms as a result of an ongoing sustainability strategy. Data collection was sourced through (qualitative and quantitative) documentary data and analysed comparatively along the relevant 2017-2019 time period.

During the 2017-2019 time period, the Trust implemented its sustainability reforms and, following, collected and published data as to its success. This time period served as an essential element in the choice and collection of an appropriate data range, narrowing down the scope of research and providing a realistic time frame for the case study. After reviewing the sustainability reforms implemented by the Manchester University NHS Foundation Trust in

2018, the potential and actualised benefits of these reforms were examined and compared with the progress data of the following year.

The collected data was obtained through England's NHS database directly. As the relevant healthcare institutions under research operate within the NHS, the health system, subsequently, possesses the relevant raw, primary data within their databases, which is made available to the public via reports and strategic plans of action. The type of material collected and analysed for this case study consisted of Annual Reports, Annual Sustainability Reports, and Plans of Implementation and Action.

The selection of the Manchester University NHS Foundation Trust as a case study for this research paper was heavily influenced by a number of factors. The NHS is considered one of the world's largest and pioneering health systems in terms of sustainable healthcare, becoming the first health system worldwide to commit to a net-zero carbon target (NHS, 2020).

Previous to this formally adopted target, the NHS had already begun publishing carbon footprint reports in 2007, long before many other health systems, and was believed to be one of the first health systems to implement a carbon reduction strategy in 2009 (NHS, 2009). Additionally, the NHS became the first health and social care system to estimate its water footprint (NHS, 2018a; Wise, 2018).

This longstanding and experienced commitment to healthcare sustainability, subsequent availability and breadth of data, extended time frame available for analysis, and geographical location, lent to the influence of selecting the NHS and its trusts as a possible case study for this paper (and its aim to

assess the potential benefits of health system sustainability and whether these have been met). This choice of a best-practice case study follows the logic that if leading institutions have not realised their potential, then other institutions are also likely to be lagging. This also implies a limited potential to extrapolate certain (negative) findings beyond the individual case.

The Manchester University NHS Foundation Trust is the largest acute trust within the United Kingdom, generating substantial waste and carbon as a result of their service delivery, significantly impacting the wellbeing and health of employees and communities, and possessing great responsibility in terms of ensuring financial stability. The Trust has expressed its leadership role within the NHS in responding to the sustainability agenda, working to ensure the successful implementation of sustainable reforms amongst its stakeholders (NHS, 2019b). In 2018, the Manchester University NHS Foundation Trust implemented their Sustainable Development Management Plan and subsequently published data annually as to the plan's progress.

As such, the overall impact, volume and availability of data, and room for analysis of a sustainability reform proved much greater in the case of the Manchester University NHS Foundation Trust compared to other, smaller health systems.

A case study approach is not without its limitations. Notably, there is the possibility of having selected an inappropriate case for this paper's research purpose. This pitfall, however, was potentially mitigated through the extensive, in-depth knowledge of relevant theoretical and empirical literature that was gathered in this paper's literature review and subsequently justified the Manchester University NHS Foundation Trust case choice (Crowe et al.,

2011). Additionally, case study research has the potential of becoming unbound and hard to define (Crowe et al., 2011). This issue was mitigated by the study design's limited time period, clearly defining what was inside and outside the scope of this case.

Further, the outcome of the case study may or may not have integrated accordingly into the theoretical framework (Crowe et al., 2011). Consequently, however, the possibility of having to pilot other preliminary explanations was not eliminated, and any contradictory issues that did emerge were not concealed. Transparency was maintained and made available to the reader through the descriptive process of case selection, data collection, and rationale behind each taken action and conclusions reached.

4. Expert Interview: Dr Willi Haas

Dr Willi Haas is currently a university assistant, senior researcher, and lecturer at the Institute of Social Ecology, University of Natural Resources and Life Sciences in Vienna, Austria. In addition to the research fields of Development and Sustainability, Environmental Justice, Socio-Ecological Transition, Circular Economy, Material Flow Accounting, Inter- and Transdisciplinarity, and Health and Climate Change, Dr Haas also specialises in Sustainability and Health.

Further, Dr Haas' publications are extensive, ranging from peer-reviewed articles to book chapters and edited volumes, assessment reports, working papers, and project reports. In terms of project experience in the health sector, Dr Haas has been involved in numerous projects, such as

“HealthFootprint - The Carbon Footprint of Austria’s Health Sector” for the Austrian Climate Research Program (ACRP), as co-chair, project leader, and researcher.

As health systems may vary from one nation to the next, it was significant to acquire Dr Haas’ understanding of the term. Dr Haas defined a sustainable health system as one which aims to improve the public health of a country, consequently through active health promotion, and plays an active role in all policies (such as transport, energy, and nutrition/agricultural policy) for the sake of health gains and overall health protection (personal communication, October 4, 2020).

In terms of its environmental impact, the detriment of health systems involves high greenhouse gas emissions, large quantities of toxic wastes, and the lack of environmentally-sound procurement strategies (W. Haas, personal communication, October 4, 2020).

Socially, health systems contribute to occupational burnout, disregard and mistreatment of employees, a lack of attention towards health-promoting jobs, and social conflict between various governing bodies (W. Haas, personal communication, October 4, 2020).

Dr Haas also acknowledged several issues in regard to finance, including both the wasteful use of financial resources and scarce funding of sustainability initiatives, as well as the increasing burdens to society and the environment resulting from money-saving initiatives (personal communication, October 4, 2020).

Dr Haas elaborated that sustainable hospitals, a key element within health systems, place priority on possible health interventions such as high-quality counselling, emphasis on promoting healthy lifestyles, low-impact diagnosis, and careful consideration of the most appropriate use of medication and surgery (personal communication, October 4, 2020).

Additionally, sustainable hospitals opt for optimised, patient-specific care paths with the goal of avoiding misallocation and unplanned readmissions (W. Haas, personal communication, October 4, 2020). A sustainable hospital's operations, planning, and management are designed to achieve economic feasibility and minimise environmental pressures (in situ and upstream) in order to achieve optimum social relations (patients, friends, relatives, staff, self-help groups, providers of services and goods, and financing bodies) (W. Haas, personal communication, October 4, 2020).

Barriers to achieving health system sustainability, Dr Haas explained in his professional experience, included power struggles between politicians, administrators, doctors, other medical staff, the pharmaceutical industry, and the medical technology industry (personal communication, October 4, 2020). Notably, stakeholders geared towards the advancement of medical science and cost-intensive care are only to a low degree in line with the aim of improving public health (W. Haas, personal communication, October 4, 2020).

Further, Dr Haas went on to add that pathways to overcoming barriers to health system sustainability involved the transparent and inclusive development of sustainable health strategies at all levels (personal communication, October 4, 2020). Inclusivity particularly, among patients,

friends, relatives, staff, self-help groups, providers of services and goods, and financing bodies, is necessary in order to ensure balanced social relations (W. Haas, personal communication, October 4, 2020).

Dr Haas concluded that health-centred strategies need to be sustainable since sustainability is ultimately nothing other than health (personal communication, October 4, 2020).

The expert opinions on sustainable health systems offered by Dr Haas strongly supports what is detailed in the literature. Health systems are capable of grossly impacting the environment, placing increasing pressures on societies and their workforces, and draining national finances. Dr Haas corroborates the literature on the importance of disease prevention, health promotion and patient-centred strategies in the movement towards health system sustainability.

Further, the expert opinions of Dr Haas reiterate what is seen in the literature regarding barriers and pathways to health system sustainability. Tackling barriers to health system sustainability, such as power struggles and ulterior motives of various stakeholders (issues raised by Dr Haas and the literature both), requires persistent and synergistic efforts from all parties involved within the system to implement sustainable, transparent, inclusive, and health-centred strategies at all levels.

5. Case Study: Manchester University NHS Foundation Trust, England

5.1. Overview

Established in 2017 and belonging to the United Kingdom's NHS, the Manchester University NHS Foundation Trust (MFT) consists of nine hospitals (Altrincham Hospital, Manchester Royal Eye Hospital, Manchester Royal Infirmary, Royal Manchester Children's Hospital, Saint Mary's Hospital, Trafford General Hospital, University Dental Hospital of Manchester, Wythenshawe Hospital, and Withington Community Hospital) and a workforce of over 20,000 employees, providing primary care to approximately 750,000 people within the Manchester and Trafford area, and treating around 2,000,000 patients annually (NHS, 2018a).

As such, the MFT is one of the largest acute trusts within the United Kingdom, boasting renowned specialised services to the North West of England in the areas of Vascular, Cardiac, Breast Care, Respiratory, Urology Cancer, Women's Services, Paediatrics, Ophthalmology, and Genomic Medicine (NHS, 2018a).

The MFT, along with all other NHS organisations, are required to adhere to regulations regarding their environmental impact. Firstly, they are legally obligated to adhere to the United Kingdom's Climate Change Act (CCA), which necessitates an 80% reduction in carbon emissions by 2050 (NHS, 2018a). In addition, it is a requirement for all NHS organisations to possess a Board-certified Sustainable Development Management Plan (SDMP), which is monitored and evaluated, as well as interactive with staff, service

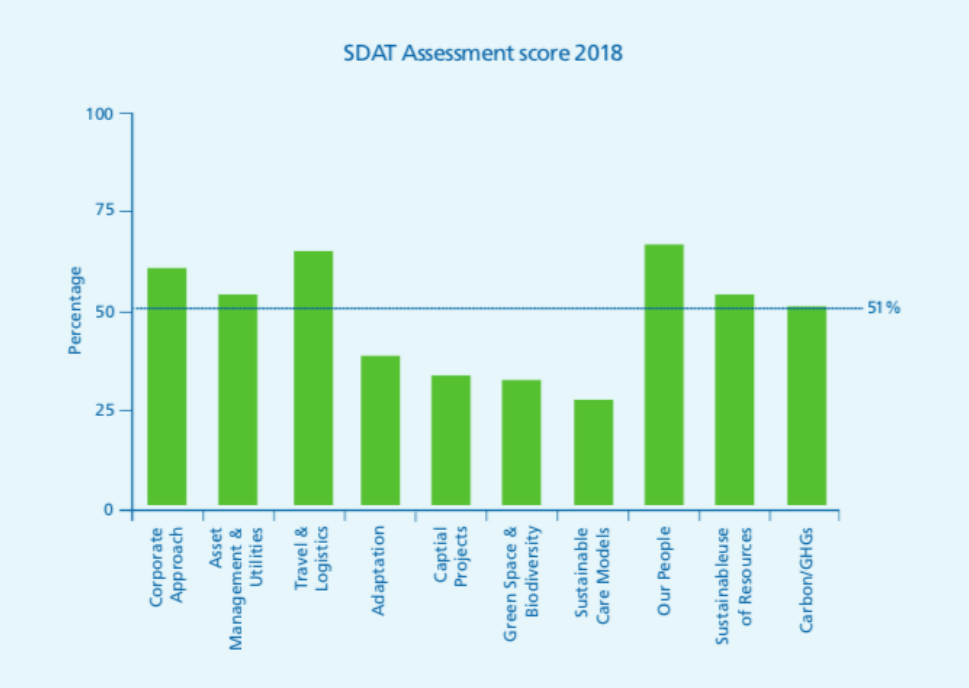
users, and the public (NHS, 2018a). As a result, the MFT developed an SDMP in 2018 titled The Masterplan, which set out a strategy to meet these, among other, sustainability goals. The Masterplan would run from 2018 until 2023 (NHS, 2018a).

The MFT has repeatedly acknowledged that collaborative action between multi-stakeholder partnerships is necessary in order to deliver sustainable healthcare (NHS, 2018a). In November of 2019, the MFT took their sustainability goals a step further by joining other organisations and healthcare institutions to declare a climate emergency (NHS, 2019). This declaration would fast-track the MFT's actions on climate change and the delivery of sustainable healthcare, notably efforts to deliver a carbon-neutral city-region by 2038 (NHS, 2019).

The MFT's SDMP, developed in line with the United Nations Sustainable Development Goals (SDGs), involves four core themes: Environment, Health, Future, and Community. The Environment theme, firstly, aims to realise environmental gain through improvements in efficiency and resource-use across the MFT's healthcare facilities (NHS, 2018a). Secondly, the Health theme seeks to improve the overall health and wellbeing of patients and staff by providing healthy spaces and empowering healthy choices (NHS, 2018a). The Future theme focuses on increasing resilience to prepare for future demands and pressures (NHS, 2018a). Finally, the Community theme sees to the MFT's delivery of social value (NHS, 2018a). In order to achieve sustainable healthcare, the MFT acknowledges that a systemic incorporation of the United Nations SDGs into the core of their organisation, corporate strategy, and across activities is needed (NHS, 2018a).

A self-assessment healthcare sector tool known as the Sustainable Development Assessment Tool (SDAT) assesses the four core themes across ten modules. These ten modules include Corporate Approach, Asset Management and Utilities, Travel and Logistics, Adaptation, Capital Projects, Greenspace and Biodiversity, Sustainable Care Models, Our People, Sustainable Use of Resources, and Carbon / Greenhouse Gas Emissions (NHS, 2018a). The SDAT is used by the MFT to measure progress in their qualitative performance (NHS, 2018a). To ensure a fair justification of the SDAT scoring, an evidence file and strict audit trail is maintained (NHS, 2018a). The MFT's SDAT assessment score for 2018 was 51%, slightly above average in comparison to other similar acute trusts (NHS, 2018a).

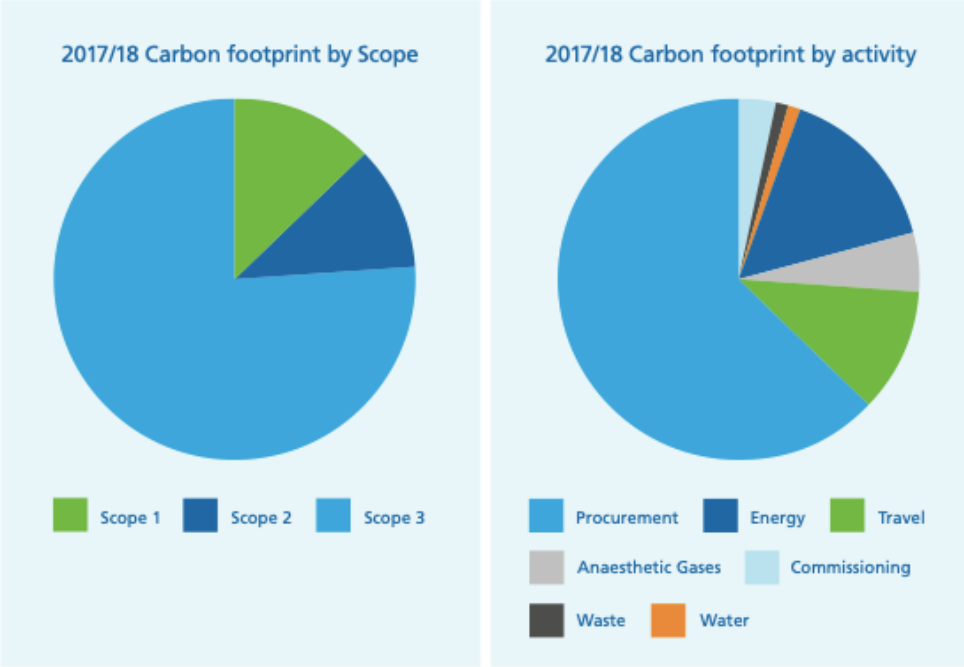
Figure 1: MFT's SDAT Assessment Score for 2018



From *The Masterplan: Making Sense of Sustainable Healthcare 2018-2023*, Manchester University NHS Foundation Trust, National Health Service, 2018a.

The MFT's carbon footprint is categorised into three scopes, with Scope 1 covering direct emissions from activities, Scope 2 covering indirect emissions (such as from the use of anaesthetic gases and burning of gas to produce heat), and Scope 3 covering all other indirect emissions along the Trust's value chain (including procurement, transport-related activities not under the Trust's direct control, and outsourced activities) (NHS, 2018a). Scope 1 and 2 emissions are responsible for 23% of the MFT's total carbon footprint, while Scope 3 emissions account for 77% (NHS, 2018a).

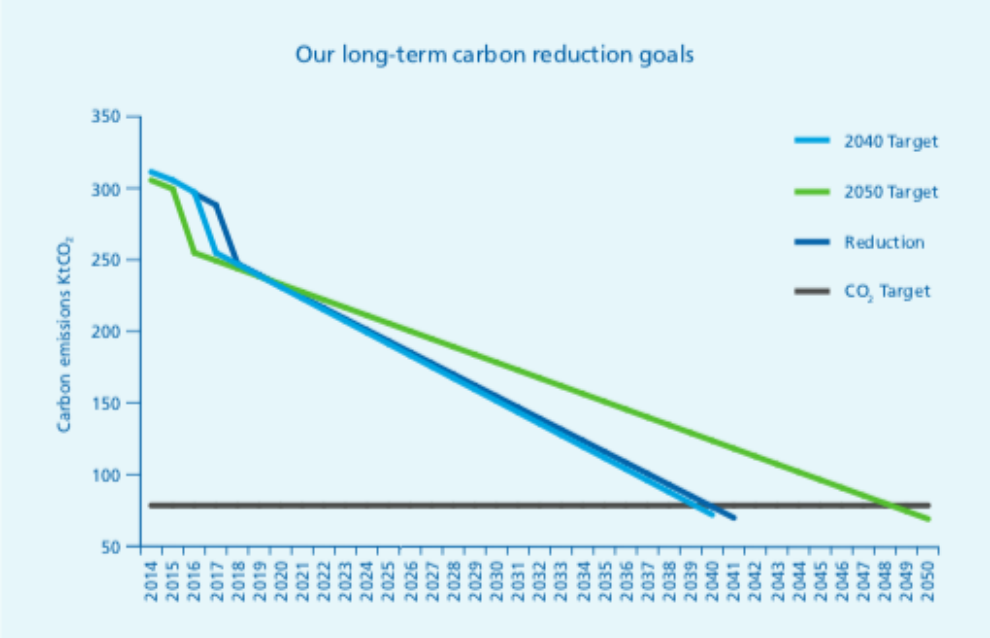
Figure 2: MFT's 2017-2018 Carbon Footprint by Scope and by Activity



From *The Masterplan: Making Sense of Sustainable Healthcare 2018-2023*, Manchester University NHS Foundation Trust, National Health Service, 2018a.

In line with their sustainable healthcare strategy, the MFT established three main overarching goals. The first goal of the MFT SDMP is to reduce Scope 1 and Scope 2 emissions by 1% annually and reduce total carbon footprint (Scope 1, 2, and 3) by 3% annually (benchmarked against patient contact and gross internal floor space) (NHS, 2018a).

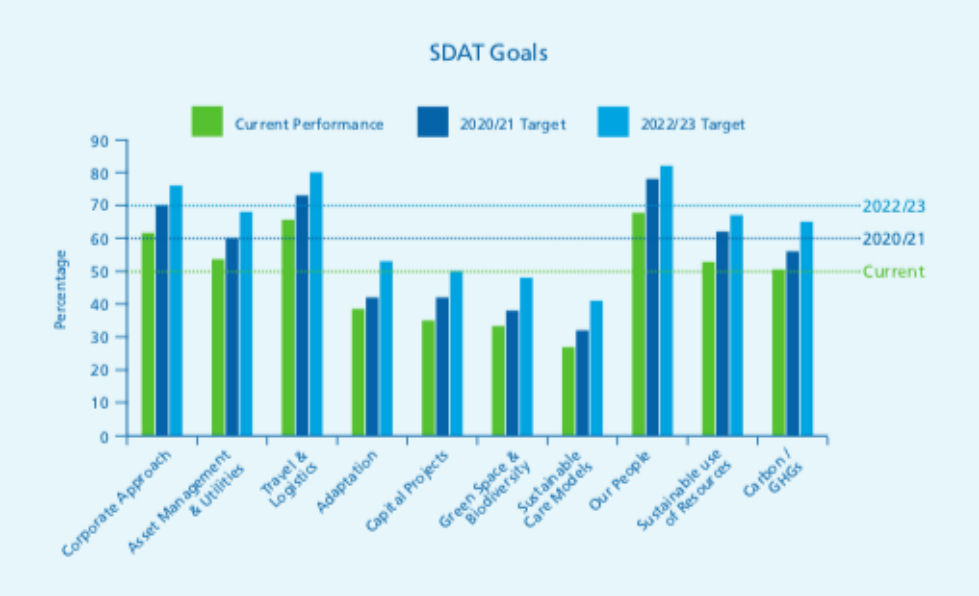
Figure 3: MFT's Long-Term Carbon Reduction Goals



From *The Masterplan: Making Sense of Sustainable Healthcare 2018-2023*, Manchester University NHS Foundation Trust, National Health Service, 2018a.

The second goal of the Trust's SDMP is to achieve an overall SDAT score of 70% or higher within the duration of the SDMP (NHS, 2018a).

Figure 4: MFT's SDAT Goals



From *The Masterplan: Making Sense of Sustainable Healthcare 2018-2023*, Manchester University NHS Foundation Trust, National Health Service, 2018a.

The third goal of the MFT's SDMP is to incorporate the United Nations SDGs into the MFT's sustainability activities, including all related strategies, policies, and plans (NHS, 2018a).

5.2. Analysis of Sustainability Reforms

In a bid to meet their SDMP goals, the MFT implemented several objectives in 2018 in accordance with their ten SDAT modules (Corporate Approach, Asset Management and Utilities, Travel and Logistics, Adaptation, Capital Projects, Greenspace and Biodiversity, Sustainable Care Models, Our People, Sustainable Use of Resources, and Carbon / Greenhouse Gas Emissions) (NHS, 2018a).

Subsequently, in 2019, the MFT published an Annual Sustainability Report providing a detailed update on the MFT's performance for the year 2018-2019 following the implementation of their board approved SDMP in 2018. The report includes a progress update on the activity delivered in each of the ten areas of focus (Corporate Approach, Asset Management and Utilities, Travel and Logistics, Adaptation, Capital Projects, Greenspace and Biodiversity, Sustainable Care Models, Our People, Sustainable Use of Resources, and Carbon / Greenhouse Gas Emissions).

Additionally, the achieved SDAT scores (refer to Table 7) of each focus area was indicated (NHS, 2019). To reiterate, the SDAT offers a measure of the MFT's qualitative progress on sustainability, which aims to reach an overall SDAT score of 70% within the next five years (NHS, 2019). In the report, there were several significant points mentioned in regard to the progress made (or lack thereof) on SDAT scores. Firstly, the Corporate Approach SDAT score saw no progress from the previous year due to time spent on

developing the new strategy (NHS, 2019). Secondly, the Travel and Logistics SDAT score decreased by over a percentage point as a result of the outdated travel strategy and a lack of dedicated sustainable travel capacity within the team (NHS, 2019). Lastly, the Green Space and Biodiversity SDAT score increased considerably by 6% due to a successful natural capital assessment and implementation of a strategic approach (NHS, 2019).

Table 4: MFT's SDAT Assessment Score 2018-2019 Comparison

Area of focus	2018 score	2019 score	% change
Corporate approach	61.64%	61.64%	0%
Asset management and utilities	53.62%	56.52%	+2.9%
Capital projects	35%	36.67%	+1.67%
Green space and biodiversity	33.33%	39.13%	+5.8%
Sustainable care models	26.92%	32.05%	+5.13%
Travel and logistics	65.62%	64.58%	-1.04%
Our people	67.74%	73.12%	+5.38%
Climate change adaptation	38.45%	41.03%	+2.57%
Carbon and greenhouse gases	50.45%	55.86%	+5.41%
Sustainable use of resources	52.78%	58.33%	+5.55%
Total	51%	54%	+3.00%

From *Annual Sustainability Report 2018-2019*, Manchester University NHS Foundation Trust, National Health Service, 2019.

The MFT's 2018-2019 report also included a Key Performance Indicator (KPI) dashboard (refer to Table 8), tracking progress within the areas of Carbon, Utilities, Renewables, and Waste (NHS, 2019). Within the Carbon section, the Trust experienced a rise in procurement emissions post-merger due to greater accuracy in reporting Scope 3 emissions (NHS, 2019). Additionally, operating expenditure increased by 17% from 2016/17 to 2018/19 (NHS, 2019). Further, Scope 2 emissions from electricity decreased due to high levels of decarbonisation from the grid, considerably reducing carbon factors (NHS, 2019). The Utilities section experienced a roughly 12 million kWh decrease from the baseline year as a result of less weather-dependent gas usage (due to increasingly frequent hotter days in the last few years) (NHS, 2019). Additionally, the Waste section encountered a significant decrease in recycling weights (and increase in recovery weights) in 2015-2016 due to a change in contractor for waste disposal (NHS, 2019).

Table 5: MFT's KPI Dashboard 2013-2019 Comparison

		2013/14 (baseline)	*2014/15*	*2015/16*	*2016/17*	*2017/18*	*2018/19*	*Trend (vs. 17 - 18)*	*Trend (vs. baseline)*
Carbon	*Scope 1 / tCO_2*	*30,650*	*33,171*	*35,376*	*35,709*	*37,272*	*31,063*	*DOWN*	*UP*
	Scope 2 / tCO_2	*38,236*	*42,368*	*39,042*	*35,240*	*29,564*	*24,066*	*DOWN*	*DOWN*
	Scope 3 / tCO_2	*239,445*	*223,184*	*230,816*	*209,560*	*304,480*	*277,783*	*DOWN*	*UP*
	Total /	*308,33*	*298,72*	*305,23*	*280,50*	*371,31*	*332,91*	*DOWN*	*UP*

	tCO_2	*1*	*2*	*4*	*8*	*6*	*2*		
Utilities	*Electricity / kWh*	*85,830,494*	*85,719,355*	*84,470,986*	*85,522,611*	*84,092,708*	*85,018,408*	*UP*	*DOWN*
	Gas / kWh	*154,313,925*	*142,454,491*	*146,357,726*	*138,439,513*	*147,313,215*	*142,232,066*	*DOWN*	*DOWN*
	Water / m^3	*574,747*	*617,328*	*584,409*	*634,448*	*620,335*	*627,097*	*UP*	*UP*
Renewables	*Onsite electricity from renewables / kWh*	*-*	*-*	*-*	*-*	*70,905*	*80,477*	*UP*	*N/A*
Waste	*Recycling / tonnes*	*2,787*	*2,763*	*1,671*	*1,590*	*1,889*	*1,960*	*UP*	*DOWN*
	Recovery / tonnes	*120*	*457*	*1,966*	*2,505*	*2,648*	*2,599*	*DOWN*	*UP*
	Landfill / tonnes	*312*	*1,663*	*1,461*	*1,289*	*1,350*	*1,250*	*DOWN*	*UP*
	Incineration / tonnes	*1,669*	*1,710*	*1,287*	*772*	*745*	*705*	*DOWN*	*DOWN*

From *Annual Sustainability Report 2018 - 2019*, Manchester University NHS Foundation Trust, National Health Service, 2019.

The upcoming section will investigate the sustainability reforms proposed by the MFT in 2018 within each of their ten areas of focus (Corporate Approach, Asset Management and Utilities, Travel and Logistics, Adaptation, Capital Projects, Greenspace and Biodiversity, Sustainable Care Models, Our People, Sustainable Use of Resources, and Carbon / Greenhouse Gas Emissions) followed by analyses of the progress made towards meeting the MFT's goals and actualised benefits achieved by the Trust as a result of

implementing sustainable reforms within their health system in the 2018-2019 year. Additionally, the expert opinions of Dr Haas will be contributed in this section to assist in the analysis and evaluation of the MFT's SDMP.

5.2.1. Corporate Approach

The objective of the Corporate Approach module is to establish a foundation of sustainability within the MFT's organisational strategy and processes (NHS, 2018a). The MFT recognises that in order to implement a sustainability strategy successfully, essential employees, stakeholders, and governors would need to engage in, and remain accountable for, its delivery (NHS, 2018a). In addition, organisational policies, procedures, business cases, and processes should harmoniously reflect this attitude (NHS, 2018a).

5.2.1.1. Corporate Approach: Proposed Reforms

The MFT proposed an implementation of the following reforms:

- Realisation of environmental gain
    - Maintenance of an ambitious and up to date strategy
    - Quarterly performance reports to senior management
    - Annual performance reports to the Board
    - Sustainability leadership and training programme for staff and governors
    - Regular sustainability performance feedback paths for staff, patients, and visitors (NHS, 2018a)
- Enhancement of health and wellbeing
    - Public health promotion and community service through support of the Manchester Local Care Organisation (MLCO)

    - Development of a ‘Healthy Estate’ to improve environmental determinants of health, such as air quality, food, green space, active travel, and biodiversity (NHS, 2018a)
- Readiness for the future
    - Development and delivery of a sustainable procurement strategy
    - Development of a Sustainability Impact Assessment for Business Cases (NHS, 2018a)
- Delivery of social value
    - Contribution to and delivery against key local environmental strategies
    - Distribution of knowledge and progress within the healthcare sector and beyond
    - Creation of opportunities for the local community, such as through employment and work experience (NHS, 2018a)

In order to measure the progress made in the Corporate Approach module, the SDAT score would firstly be calculated and assessed in line with targets. In addition, annual sustainability surveys would measure staff awareness levels. Finally, the annual report would include an extensive sustainability segment (NHS, 2018a).

5.2.1.2. Corporate Approach: Progress and Actualised Benefits

The MFT achieved progress in the Corporate Approach module for the year 2018-2019. Firstly, the Trust developed a plan of action and published their SDMP. This plan was one of the first to apply new national guidelines, and across the industry was cited as best practice (NHS, 2019). Throughout the

2018-2019 year, the MFT held workshops with key stakeholders and conducted launch events across the Trust (NHS, 2019). Additionally, the MFT was recognised with “Excellence in Sustainability Reporting” for their 2017-2018 contributions (NHS, 2019).

The Trust maintained continued quarterly meetings with the Chairman (i.e., board sustainability lead) and remained persistent in hosting presentations to share their work and progress across the broader healthcare sector (at NHS Sustainability Day Roadshows, Healthcare Estates Conference, National NHS Sustainability Leads Group, and Sustainable Development Unit events) (NHS, 2019). In addition, the MFT contributed to developing the commitments for the healthcare sector included within the GMCA Environment Plan and Manchester Zero Carbon by 2038 draft plans (NHS, 2019).

Although the Trust achieved progress in the 2018-2019 year, the MFT’s SDAT score of 61.64% (NHS, 2019) remained unchanged from the previous year (NHS, 2018b).

5.2.1.3. Corporate Approach: Evaluation

The SDMP’s Corporate Approach module and its intended goals corroborated several points discussed in the literature review regarding the transition to greater health system sustainability, especially in terms of the need for a holistic, strategic perspective. Having developed the SDMP as a general and comprehensive plan of action to be taken by the Trust and its shareholders, followed by setting the intention to collect data and subsequently publish performance reports, the MFT has followed what was

revealed in the literature review to be the steps needed in order to successfully implement a strategic management approach (Fischer, 2015).

Not only that, but the MFT's SDMP also tackles the concept of shared knowledge within its Corporate Approach module. In the literature covering health system sustainability, shared knowledge, particularly the clear and transparent communication of societal externalities and trade-offs (Fischer, 2015), was deemed a key element in the transition to greater health system sustainability. This issue was addressed in the Corporate Approach module through the intention and aim to distribute knowledge and progress within the healthcare sector and beyond (NHS, 2018a).

The topic of disease prevention and health promotion was also covered within the Corporate Approach module. Referencing back to the literature regarding health system sustainability, the movement towards disease prevention and health promotion revealed that prevention and promotion ventures significantly improve health outcomes for less cost (Fisher, 2015).

Within the Corporate Approach module, the MFT indicated their aim to contribute to public health promotion and community service through the support of the MLCO (NHS, 2018a). This also ties into the integral role of HRH in prevention and promotion ventures and the need for committed, high-level staff to provide quality services (Fischer, 2015). This was also addressed in the Corporate Approach module through the intended aim of developing a sustainability leadership and training programme for staff and governors, as well as sustainability performance feedback paths for staff, patients, and visitors (NHS, 2018a).

The Corporate Approach module's objective to create opportunities for local communities and improve local population health also corroborates with the topics of population support and patient empowerment seen in the literature review. Further, the institutionalisation of environmental concerns (Fischer, 2015) was also addressed within this module through the intended aims of developing a Healthy Estate (to improve environmental determinants), creating a sustainable procurement strategy, and contributing to key local environmental strategies (NHS, 2018a). As was mentioned in the literature review, health system sustainability involves taking into account interdependencies and interlinkages and prioritising the reduction of its environmental detriment and consumption (Fischer, 2015).

In terms of working towards their aims and actualising benefits, it is difficult to assess the true depth of the MFT's actions. Although the MFT's 2018-2019 progress report contains information on what the Trust achieved during the year, it isn't exactly clear how and to what extent the Trust has reached these achievements. This could be a potential threshold to consider, particularly in regard to increased transparency and communication to more effectively allow inefficiencies in the system to be brought to light (Fischer, 2015).

Although progress in certain goals within this module seems to have been made, other goals such as the creation of opportunities for local communities, delivery of a sustainable procurement strategy, establishment of a Healthy Estate aimed at improving environmental determinants, and establishment of a sustainability leadership programme for staff and governors have not been detailed within the 2018-2019 annual report. However, as this is the first year after the rollout of The Masterplan, it would

be logical to assume that such significant changes require a long-term timeframe and have not, as of yet, been actualised.

The Corporate Approach module, with an aim to ensure sustainability is incorporated into the MFT's organisational strategies and processes (NHS, 2018a), experienced no improvements in its SDAT score, remaining at a score of 61.64% in comparison to the previous year.

Institutional accountability and stakeholder participation are critical elements in the movement towards greater health sustainability (Fischer, 2015), and as such, may experience the greatest resistance to transformation. Involving numerous stakeholders in decision-making processes and aligning objectives to evolve into one common aim for future development is no simple feat and could account for the stagnation of this module's SDAT score.

5.2.2. Asset Management and Utilities

The objective of the Asset Management and Utilities module is to implement water- and energy-efficient technologies and practices across the MFT's healthcare facilities and services (NHS, 2018a). As a result, the Trust aims to deliver year-on-year reductions in consumption (NHS, 2018a). As is the case with healthcare systems, the MFT's healthcare activities are intensive and unabating, leading to utilities that are extensively costly and impactful to the environment.

In order to ensure sustainability through efficiency and minimisation of environmental impact, the MFT acknowledges that it is critical to measure and reduce consumption accurately (NHS, 2018a). In an aim to improve

utility efficiency, the MFT intends to implement new technologies, increase efficiency, and improve employee awareness across everyday activities, as well as longer-term projects (NHS, 2018a).

5.2.2.1. Asset Management and Utilities: Proposed Reforms

The MFT proposed an implementation of the following reforms:

- Realisation of environmental gain
    - Monitorization of utility consumption across the MFT's Estate
    - Implementation of targeted energy and water efficiency schemes in order to manage and decrease use wherever possible
    - Specification of renewable energy when entering new purchasing arrangements for electricity
    - Education of employees, patients, and visitors in terms of their actions and effect on energy and water consumption (NHS, 2018a)
- Enhancement of health and wellbeing
    - Quicker response time in terms of issues such as leaking and overheating through more effective monitoring and leak detection systems
    - Education of employees on the importance of improving home energy efficiency (NHS, 2018a)
- Readiness for the future
    - Further development and increase of on-site energy generation capacity using renewable resources
    - When purchasing new equipment, conduct assessments of energy and water lifecycle costs to assist decision-making

    - Incorporation of energy and water efficiency criteria when leasing buildings, as well as a definition of minimum standards for sustainability
    - Identification of inefficient buildings leased by the Trust, followed by applications of request for improvement or identification of alternatives if minimum standards for sustainability cannot be met (NHS, 2018a)
- Delivery of social value
    - Collaborations with community partners in order to maximise the use of built assets and grounds
    - Monitorization of air quality impacts for on-site combustion activities such as biomass (NHS, 2018a)

In order to measure the progress made in the Asset Management and Utilities module, the MFT would analyse Estate Return Information Collection (ERIC) returns, percentage use of energy from renewable resources, and data (for individual facilities, when possible) on utility consumption and cost (NHS, 2018a). The ERIC provides information on the costs for providing, maintaining, and servicing the NHS Estate (NHS, 2019a).

5.2.2.2. Asset Management and Utilities: Progress and Actualised Benefits

The MFT's Estate conducts constant and intensive activities across over 560,000 square meters of occupied floor space, resulting in sizable utility costs and externalities (NHS, 2019). This expanse of space and activity means that the Asset Management and Utilities module holds great importance in the grand scheme of increasing the MFT's health system sustainability through reforms.

In the 2018-2019 year, the Trust was able to achieve a beneficial 1.78% reduction in total energy use (NHS, 2019). In addition, a 3.45% reduction in gas usage was also indicated (NHS, 2019).

Further energy efficiency progress was made, including the installation of LiteIP LED lighting technology within the newly refurbished Trafford General Hospital (NHS, 2019). This change in lighting technology led to an annual saving of £6,500 (NHS, 2019). Solar film was also installed on critical windows at the Oxford Road Campus, which led to beneficial savings on heating, increased insulation, and improved working conditions (NHS, 2019). The Oxford Road Campus also experienced increased technology efficiency through the procurement of an automatic meter read system and the installation of circuit-level sensors (NHS, 2019).

The SDAT score of the Asset Management and Utilities module for the 2018-2019 year totalled 56.52% (NHS, 2019), an increase from the 53.62% (NHS, 2018b) of the previous year.

5.2.2.3. Asset Management and Utilities: Evaluation

It seems as though the Trust has made significant progress in the field of utility costs and their environmental impact, considering only one year has passed since the implementation of the SDMP reforms.

Cost-control and the revision of existing approaches (Fischer, 2015) is considered a key issue in the movement towards greater health system sustainability; the MFT appears to be reaping the benefits of cost reductions,

increased efficiency, and annual savings as a result of implementing such cost-control measures through the Asset Management and Utilities goals.

Educating staff, patients, and visitors on their actions and effects on energy and water consumption was proposed within the Asset Management and Utilities module. These proposed actions strongly support what was mentioned in the literature review concerning employee, patient, and societal empowerment, in addition to the improvement of staff knowledge and behaviour (Fischer, 2015). Stakeholder compliance increases as their knowledge on the issues of health system sustainability increases (Fischer, 2015). Unfortunately, the 2018-2019 sustainability report did not offer additional details on progress made in this area.

The SDMP's Asset Management and Utilities module highlights the environmental actions which health systems should take in order to reduce environmental detriment. The existing literature on health system sustainability has demonstrated that renewable energy sources should be the primary energy source within medical settings, with a primary focus on efficient energy and water consumption (Fischer, 2015).

The MFT's progress towards renewable energy usage appears limited, or possibly in its early stages, due to the lack of updates within the Trust's 2018-2019 report. However, the MFT achieved a reduction of their total energy usage within the 2018-2019 year, correspondingly to what the literature described as a conscious utilisation of resources (rather than an unrealistic elimination of non-renewables entirely) (Fischer, 2015).

5.2.3. Capital Projects

The objective of the Capital Projects module is to reduce the impact of the MFT's building works during its design, refurbishment, construction, operation, and decommissioning stages (NHS, 2018a). Further, the MFT's goal is to refurbish and develop their Estate in order to incorporate sustainable and efficient practices, using emerging technologies and smart design (NHS, 2018a). To do this, the MFT indicates that a whole-life-costing approach to projects is necessary, whereby sustainability in design, construction, operation, commissioning, and decommissioning would be considered (NHS, 2018a).

5.2.3.1. Capital Projects: Proposed Reforms

The MFT proposed an implementation of the following reforms:

- Realisation of environmental gain
    - Development of sustainability guidelines for all Capital Projects, including major refurbishments
    - Propellent of resource efficiency through the Estates Strategy
    - Execution of a design-for-performance approach to Capital Projects, including an application of the BSRIA Soft Landings Framework
    - Nomination of a sustainability lead to work alongside the capital team on large-scale projects, with the application of recognised methodologies such as BREEAM to guide appropriate measures and maximisation of benefits
    - Notification of staff on the heating, cooling, lighting, and ventilation operation within their respective healthcare facilities, along with possibilities for reporting performance issues (NHS, 2018a)

- Enhancement of health and wellbeing
    - Prioritisation of access to natural light, ventilation, greenspace, and active travel infrastructure within the development and refurbishment of the MFT's Estate (NHS, 2018a)
- Readiness for the future
    - Coordination with contractors on the implementation of whole-life-costing approaches to new building designs and refurbishments while also ensuring the maximisation of in-use energy and water efficiency
    - Incorporation of sustainability in the refurbishment and decommissioning undertaking (NHS, 2018a)
- Delivery of social value
    - Consideration of potential social values when procuring new services in the design and building of projects, such as the use of local suppliers and small businesses (NHS, 2018a)

In order to measure progress made in the Capital Projects module, the MFT would investigate energy and water consumption, including design and in-use performance (NHS, 2018a). In addition, a score using the BREEAM or the WELL Building Standard performance-based system would be calculated (NHS, 2018a).

5.2.3.2. Capital Projects: Progress and Actualised Benefits

The SDAT score for the Capital Projects module increased from 35% (NHS, 2018b) to 36.67% in the 2018-2019 year (NHS, 2019). In an aim to increase sustainability and reduce the environmental impact in all stages of the MFT's

building works, the Trust managed to achieve progress in the 2018-2019 year.

Firstly, the Department of Laboratory Medicine Specimen reception labs underwent a redesign in order to establish the space as one that incorporates sustainability, efficient resource management, and wellbeing (NHS, 2019). In addition, staff received education through the successful implementation of Operation TLC, an award-winning behaviour change programme, on the ins and outs of heating, cooling, ventilation, and lighting operations of the healthcare buildings in which they worked (NHS, 2019). Finally, the MFT's Property and Estates team engaged with Green Impact to incorporate sustainability practices within the department to increase efficiency and cut costs (NHS, 2019).

5.2.3.3. Capital Projects: Evaluation

The goals of the Capital Projects module are similar to those in the previous module (Asset Management and Utilities) in that the underlying aim is to minimise environmental detriment and promote sustainable resource utilisation.

The MFT successfully delivered a programme to educate staff on sustainability within healthcare facilities, thereby achieving greater employee empowerment and willingness to accept greater responsibility for sustainability (Naylor & Appleby, 2012). This allocation of responsibility and subsequent increase in staff engagement will likely steer a path towards greater sustainability (Naylor & Appleby, 2012) within the Trust.

5.2.4. Green Space and Biodiversity

The objective in the Green Space and Biodiversity module is for the MFT to maximise the quality and benefits from their green spaces, as well as reduce biodiversity loss through the enhancement and protection of their natural assets (NHS, 2018a).

The MFT's intention for their green spaces is to aid in the improvement of physical and mental wellbeing, noise reduction, biodiversity support, improved air quality, and climate change mitigation (NHS, 2018a). Further, the MFT indicated that the implementation of a straightforward and collaborative strategy with partners and local communities would contribute to local biodiversity improvements and enhanced green spaces (NHS, 2018a).

5.2.4.1. Green Space and Biodiversity: Proposed Reforms

The MFT proposed an implementation of the following reforms:

- Realisation of environmental gain
    - Development of a green space and biodiversity strategy and policies to tackle challenges and opportunities across the Estate
    - Incorporation of green space and biodiversity into the sustainability governance structure and collaborations with contractors to maximise benefits (NHS, 2018a)
- Enhancement of health and wellbeing
    - Creation of opportunities for staff to become involved in Trust-wide initiatives such as beekeeping and gardening schemes

in order to increase awareness of the benefits of natural capital for physical and mental health
    - Exploration of food growing schemes and subsequent incorporation of food products into Trust catering services (NHS, 2018a)
- Readiness for the future
    - Improvement of green spaces, biodiversity, and creation of wildflower areas through the repurposing of unused areas such as roof space and walls (NHS, 2018a)
- Delivery of social value
    - Collaborations with staff and local community organisations to provide access to quality urban green spaces and encouragement of its use (NHS, 2018a)

In order to measure the progress made in the Green Space and Biodiversity module, the Trust would evaluate the production of a green infrastructure and biodiversity strategy and subsequent delivery of an associated action plan (NHS, 2018a). In addition, the MFT stated they would take into account natural capital valuing (NHS, 2018a).

5.2.4.2. Green Space and Biodiversity: Progress and Actualised Benefits

The MFT expressed that the benefits achieved from improvements in the Greenspace and Biodiversity module are not only environmental but improve mental and physical wellbeing as well, especially for patients and staff members (NHS, 2019). In the 2018-2019 year, the MFT was assessed by the Ecological Walkovers and Natural Capital Assessment to have had 20%

of its Estate covered in green space, holding an amenity value of £26.5 million and a structural value of £1.6 million (NHS, 2019).

During the year, the Trust implemented an urban beekeeping project, producing over 100 pounds of honey and training additional new beekeepers (NHS, 2019). In addition, the Trust carried out a courtyard redesign project which led to outdoor spaces being made accessible for patients, visitors, and staff, as well as additional wildlife benefits gained through planting (NHS, 2019). Further, the MFT's Royal Manchester Children's Hospital supported a development that promoted the guidance of specific plants and trees in order to enhance air quality and support biodiversity (NHS, 2019).

As a result of the progress made in this module, the MFT achieved the highest Green Apple award for Environmental Practice and an improved SDAT score of 39.13% (NHS, 2019), compared to 33.33% from the previous year (NHS, 2018b).

5.2.4.3. Green Space and Biodiversity: Evaluation

The benefits achieved by the MFT through the Green Space and Biodiversity module lean towards improved mental and physical wellbeing of its employees and patients. Although there was an emphasis within the module's aims to sustain and improve green space across the Estate and indirectly combat climate change (through carbon storage), improve air quality, support biodiversity and incorporate self-grown food into the Trust's supply chain, it seems as though final actions taken by the Trust (for the 2018-2019 year) shifted towards the improvement of staff and patient wellbeing. While undoubtedly an important issue, this has led to a potentially

significant shortfall in terms of addressing and improving environmental strategies within the MFT's sustainability governance structure.

In the MFT's SDMP, the Green Space and Biodiversity module included the proposed reforms of developing biodiversity and green space strategy policies, as well as the incorporation of biodiversity and green space into the Trust's sustainability governance structure (NHS, 2018a). Any progress made in this area was either null in the first 2018-2019 year or left out of the 2018-2019 sustainability report for the time being.

The MFT did, however, assess the value of their natural capital across the Estate. This is a significant step towards potentially greater sustainability as the Trust has realised the economic value of their green spaces and resulting contributions to society's livelihood, thereby allowing its benefits to become economically visible. As such, the MFT will benefit from the ability to conduct informed and sustainable decisions regarding its natural capital.

5.2.5. Sustainable Care Models

The MFT has emphasised the need to improve clinical pathways and further support the integration of healthcare services in a way that is more efficient (NHS, 2018a), supportive to patients in receiving care closer to home, and enhances the general health and wellbeing of the population, so that hospital admissions are reduced (NHS, 2019).

Further, the MFT acknowledges that it is becoming progressively difficult to provide quality care within the available economic, environmental, and social resources and that it is now necessary to ensure the Trust's healthcare system is fit for the future as the effects of climate change begin to take a toll

(NHS, 2018a). These effects are beginning to directly influence the way diseases are spread and how the MFT cares for its patients (NHS, 2018a).

The aim of the Sustainable Care Models module is for the MFT to deliver the highest quality of care while also paying close attention to their environmental, social, and financial impact through the implementation of a systems approach strategy (NHS, 2018a).

5.2.5.1. Sustainable Care Models: Proposed Reforms

The MFT proposed an implementation of the following reforms:

- Realisation of environmental gain
    - Identification of carbon hotspots (such as pharmaceuticals and medical equipment) and confirmation that action plans identify and mitigate environmental impacts
    - Incorporation of new and existing digital technologies to mitigate the environmental effects of care, manage long-term health conditions, and prevent poor health
    - Application of sustainability principles to new and refurbished Estates in order to establish an environment of healing and support an improved quality of care
    - Incorporation of patient- and clinician-led service redesign (NHS, 2018a)
- Enhancement of health and wellbeing
    - Collaborations with stakeholders (particularly in terms of temperature, light, and food choices) to develop a healthy environment for patients

    - Implementation of a proactive approach to identify and manage the leading causes of employee illnesses (NHS, 2018a)
- Readiness for the future
    - Reduction of carbon emissions relating to areas of high impact such as anaesthetic gases and pharmaceuticals through the education of staff and promotion of lower impact alternatives
    - Collaborations with stakeholders and partners to recognise and deliver solutions that decrease the need and number of hospital visits (by facilitating treatments closer to home, e.g., macular treatment centres and home dialysis)
    - Implementation of a pilot care pathway redesign to remove any unnecessary stages (NHS, 2018a)
- Delivery of social value
    - Collaborations with partner organisations to recognise support schemes aimed at assisting vulnerable patients upon discharge, such as through home energy efficiency improvements (e.g., regulating temperatures and decreasing the chances of readmission) (NHS, 2018a)

In order to measure the progress made in the Sustainable Care Models module, the MFT would obtain patient feedback and scores, particularly patient feedback in regard to the care environment (e.g., light and temperature) (NHS, 2018a). Further, the Trust would observe employee illness rates, emergency hospital admissions, and the social and financial co-benefits achieved from implementing sustainable care models (NHS, 2018a).

5.2.5.2. Sustainable Care Models: Progress and Actualised Benefits

In the 2018-2019 year, the MFT's SDAT score for the Sustainable Care Models experienced a significant improvement, increasing to 32.05% (NHS, 2019) from the previous year's 26.92% (NHS, 2018b). During the year, the Trust achieved progress in this module through the implementation of sustainable anaesthesia training, in which staff were trained to reduce the environmental impact of their activities (NHS, 2019). In addition, the Trust began a dive into addressing clinical pathways for operating theatres in order to make them more sustainable (NHS, 2019).

5.2.5.3. Sustainable Care Models: Evaluation

The Sustainable Care Models module holds great significance within the MFT's SDMP as it tackles numerous health system sustainability challenges, including carbon emission mitigation, environmental impact reduction, the transition to digital e-health, prevention of chronic health conditions, health promotion, quality care and services, green buildings, employee and patient empowerment, employee burnout, pharmaceutical impact, and increased efficiency.

The topic of HRH, particularly, stands out within this module. With an aim to discover and manage the leading causes of employee illnesses across the Trusts (NHS, 2018a), the MFT is minimising the detriment of healthcare services amongst its workforce, leading to improved staff commitment and morale (Fischer, 2015). As such, the Trust and its employees will benefit from an improved environment and a greater ability to provide sustained, high-quality services to its patients (Fischer, 2015).

Having said that, while improving the wellbeing and quality of the MFT's workforce would be a significant achievement, this objective may not sufficiently tackle the root issues of health system sustainability and the associated importance of (Greater Manchester's) community health promotion and individual health responsibility.

According to the aims and proposed reforms put forward by the MFT in this module, the Trust's potential for greater health system sustainability appears considerable and promising. Unfortunately, when reviewing the MFT's 2018-2019 report, it would seem that the Trust hadn't yet achieved sizeable progress in the Sustainable Care Models module during the first year of the SDMP's implementation.

However, a significant benefit that the MFT achieved during the 2018-2019 year included increased employee awareness and empowerment through the incorporation of additional workforce training, areas which were highlighted in the literature review as lacking in the transition towards greater health system sustainability.

The MFT has corroborated the literature detailing the emphasis for workforces within health systems to receive education on the topic of environmental preservation (Fischer, 2015). Additionally, the MFT began addressing sustainable clinical pathways for their operating theatres during the 2018-2019 year (NHS, 2019). These actions will likely experience further actualised benefits in future.

5.2.6. Travel and Logistics

The aim of the Travel and Logistics module is to promote the use of sustainable and active travel whenever and wherever possible, reduce carbon emissions, and mitigate air pollution impacts of the organisation and its supply chain (NHS, 2018a). The Trust acknowledges that the transport of goods, services, patients, visitors, and employees significantly impacts local air quality, congestion, and health (NHS, 2018a).

The implementation of an effective travel plan and increased support of patients, visitors, and employees to use sustainable and active modes of travel would mitigate the negative impacts of carbon-intensive travel, thereby achieving health benefits while also reducing costs (NHS, 2018a).

5.2.6.1. Travel and Logistics: Proposed Reforms

The MFT proposed an implementation of the following reforms:

- Realisation of environmental gain
    - Development and implementation of a new “Healthy Travel Strategy” for the Trust, which aims to reduce single-occupancy car journeys as well as mitigate travel impacts of their supply chain
    - Reduction of the MFT fleet’s environmental impact and ensure that all new vehicles are low carbon
    - Reduction of business miles between sites and attendance of external meetings by ensuring that employees are able to access video and teleconferencing facilities
    - Observation of indoor and outdoor local air quality within the Trust’s vicinity

    - Identification of pollution hotspots and implementation of mitigation activities
    - Increase the ratio of electric vehicles within the Trust's fleet as well as the number of electric charging points accessible to employees (NHS, 2018a)
- Enhancement of health and wellbeing
    - Evaluation of Trust's travel infrastructure across all sites and development of plans to improve it
    - Ensure sustainable and active travel events, as well as changes to local transport services, are made known across main sites (NHS, 2018a)
- Readiness for the future
    - Optimisation of logistic operations as well as travel between sites in order to reduce emissions
    - Evaluation and assessment of delivery and travel in order to recognise and develop opportunities for improved efficiency (NHS, 2018a)
- Delivery of social value
    - Development of a high-quality travel infrastructure which may then also be utilised by local communities
    - Ensure travel and transport sustainability criteria is included within key contracts (NHS, 2018a)

In order to measure progress achieved in the Travel and Logistics module, the MFT plans to conduct an annual employee travel survey, measure carbon emissions from travel, evaluate air quality on-site, implement a Health Outcomes Travel Tool (HOTT), and monitor the ratio of the Trust's fleet in regard to electric vehicles and electric vehicle infrastructure (NHS, 2018a).

5.2.6.2. Travel and Logistics: Progress and Actualised Benefits

The MFT became a leader in sustainable travel in the 2018-2019 year when they were awarded the Gold Standard in the travel choices accreditation scheme, Transport for Greater Manchester (TfGM) (NHS, 2019). Further, the Trust conducted its first combined Staff Travel survey since the merger, receiving over 2,000 responses, and supported the National Clean Air day in collaboration with TfGM (NHS, 2019). Additionally, the MFT conducted indoor and outdoor air pollution monitoring at key locations (NHS, 2019).

Employees also received the beneficial addition of newly implemented electric vehicle charging points during the year (NHS, 2019). In addition to the charging points and to further encourage sustainable travel, employees of the MFT were provided with active travel support, which included discounted bus and Metrolink tickets, subsidised D-locks, and free breakfasts for cyclists (NHS, 2019).

Unfortunately, the Trust's SDAT score for the Travel and Logistics module worsened from the previous year's 65.62% (NHS, 2018b) to 64.58% in the 2018-2019 year (NHS, 2019). The MFT indicated that the SDAT score for the Travel and Logistics module decreased in comparison to the year before due to a lack of dedicated sustainable travel capacity and updated Healthy Travel Strategy (NHS, 2019).

5.2.6.3. Travel and Logistics: Evaluation

The decrease in the MFT's SDAT score for the Travel and Logistics module is an unfortunate setback, as the importance of carbon reduction and

environmental degradation mitigation continues to escalate. From the MFT's 2018-2019 report, it would seem as though the Trust is in the preliminary stages of improving its progress within the SDMP's Travel and Logistics module.

Although the Trust conducted a travel survey, oversaw air pollution monitoring, and received a sustainable travel award (NHS, 2019), it isn't clear what actions, if any, were taken to follow through with the data that the MFT received as a result of these projects. The only progress, according to the 2018-2019 report, achieved by the Trust that directly encouraged sustainable and active travel was the installation of four new EV charging points and the support of active travel for staff through discounted bus and Metrolink tickets, subsidised D-locks, and free breakfasts for cyclists (NHS, 2019).

Although these actions are a step in the right direction towards greater health system sustainability, it appears to (for the time being) fall short of the grand aims that the MFT had set for itself, such as to develop and deliver a Healthy Travel Strategy, optimise logistic operations and travel between sites, and develop a high-quality travel infrastructure that could also be utilised by the local community (NHS, 2019).

5.2.7. Our People

In order to successfully deliver sustainable healthcare, the MFT recognises that employee participation within the Trust's sustainability agenda is crucial (NHS, 2018a). Every employee of the Trust is said to have a crucial role in the successful implementation of the MFT's SDMP, whether that be at the workplace, at home, or across the Trust's supply chain and beyond (NHS, 2018a). Further, the importance of employee empowerment is not lost in the

MFT's SDMP; employees are encouraged to adopt sustainable practices in order to take ownership within their own areas of influence (NHS, 2018a).

The overarching aim of the SDMP's Our People module is to encourage and support employees to improve sustainability at the workplace as well as at home and, consequently, become empowered to act sustainably within their everyday lives (NHS, 2018a).

5.2.7.1. Our People: Proposed Reforms

The MFT proposed an implementation of the following reforms:

- Realisation of environmental gain
    - Implementation of programmes to increase sustainability awareness and opportunities for employee contributions
    - Identification of a Human Resource lead for sustainability
    - Collaborations with Human Resource to incorporate sustainability into job descriptions as well as performance reviews
    - Improve the MFT's sustainability profile at the local, regional, and national level (NHS, 2018a)
- Enhancement of health and wellbeing
    - Collaborations with employee groups to strengthen, enrich, and align the MFT's sustainability approach with other Trust initiatives
    - Encouragement and implementation of health and wellbeing work-based activities such as Bicycle User Groups to employees (NHS, 2018a)
- Readiness for the future

    - Incorporation of sustainability-based reward systems and game-type elements whenever possible to encourage sustainable behaviour and participation amongst employees (NHS, 2018a)
- Delivery of social value
    - Incorporation of various MFT SDMP-oriented development and training opportunities for employees (NHS, 2018a)

In order to measure progress made within the Our People module, the MFT would take into account the number of environmentally focused employee benefits achieved, staff participation rates within sustainability programmes, the Social Value Calculator, and the Commissioning for Quality and Innovation (CQUIN) performance data (NHS, 2018a).

5.2.7.2. Our People: Progress and Actualised Benefits

The Trust ran their first cycle of Green Impact as the merged MFT, additionally incorporating the programme at two new hospitals, Wythenshawe and Withington. A total of 42 teams participated, with over 5,000 actions completed amongst them (NHS, 2019). As a result of this, the MFT experienced actualised benefits through the reduction of around 213 tonnes of carbon dioxide equivalents and saved almost £35,000 (NHS, 2019).

In the 2018-2019 year, the Trust also trialled an energy efficiency and behaviour change project titled Operation TLC (NHS, 2019). This project, developed by the Global Action Plan, was placed into operation across twenty wards within the Saint Mary's Hospital as well as the Royal

Manchester Children's Hospital (NHS, 2019). As a result, around 52 tonnes of carbon dioxide equivalents and £20,000 were saved (NHS, 2019).

Further, the Trust continued to spread awareness of health system sustainability through the delivery of their monthly Sustainability Newsletter to over 500 employees, reaching an average reader rate of 50% (NHS, 2019). As a result of the progress made within the 2018-2019 year, the MFT achieved an improved SDAT score of 73.12% in the Our People module, compared to 67.74% (NHS, 2018b) from the previous 2017-2018 year (NHS, 2019).

5.2.7.3. Our People: Evaluation

The importance of staff empowerment, individual responsibility, and stakeholder participation in the transition to greater health system sustainability has been mentioned repeatedly within this research paper. Just by launching the Green Impact cycle within two new hospitals at the MFT and implementing Operation TLC across twenty wards, the Trust was able to save a combined 265 tonnes of carbon dioxide equivalents (NHS, 2019).

One could begin to perceive the possibilities for additional benefits and improvements within the MFT's health system if these projects were further developed and implemented across the entire Trust.

5.2.8. Climate Adaptation

The MFT acknowledges that climate change is one of the most significant public health threats that society faces, with the increasing frequency and severity of extreme weather conditions occurring (NHS, 2018a). To increase resilience, the Trust indicates that now is the time to act in order to effectively

adapt to the altering climate and mitigate the effects of past and future actions (NHS, 2018a).

As such, the MFT is increasing climate change awareness across its healthcare facilities, paying particular attention to the preparedness of its employees, infrastructure, services, procurement, and local communities against its impacts (NHS, 2018a). The overarching objective in this module is to ensure that the MFT is primed and equipped to handle the impact of climate change, notably extreme weather occurrences, and continuously investing in adaptation and mitigation efforts (NHS, 2018a).

5.2.8.1. Climate Change Adaptation: Proposed Reforms

The MFT proposed an implementation of the following reforms:

- Realisation of environmental gain
    - Nomination of Adaptation Lead
    - Incorporation of Adaptation Lead into sustainability governance structure, corporate risk register, and reporting processes
    - Investment into adaptation and mitigation technologies (NHS, 2018a)
- Enhancement of health and wellbeing
    - Maximisation of quality and resilience of green space in order to increase adaptability to climate change (NHS, 2018a)
- Readiness for the future
    - Collaborations with key internal and external stakeholders and partners to ensure the improvement and implementation of the Trust's Board-approved Climate Change Adaptation

Plan as well as unification with Manchester's Climate Strategy and national healthcare guidance (NHS, 2018a)

- Delivery of social value
    - Consideration and protection of vulnerable communities in the event of extreme weather occurrences through the Trust's emergency plans (NHS, 2018a)

In order to measure the progress made in the Climate Change Adaptation module, the Trust would implement the utilisation of a green building performance tool such as the BREEAM, WELL Building Standard, or other (NHS, 2018a). In addition, the Trust would monitor and report on the progress of their Climate Change Adaptation Plan (CCAP) (NHS, 2018a).

5.2.8.2. Climate Change Adaptation: Progress and Actualised Benefits

An improved SDAT score of 41.03% (NHS, 2019) was achieved by the MFT for the Climate Change Adaptation module in the 2018-2019 year, compared to 38.6% from the previous year (NHS, 2018b). The Trust achieved notable progress in this module through the publication of their CCAP, which was made accessible to all employees via the intranet (NHS, 2019). Also, in the 2018-2019 year, the MFT received a Sustainable Health and Care (SHC) Award in the Adaptation category (NHS, 2019).

5.2.8.3. Climate Change Adaptation: Evaluation

The Climate Change Adaptation module is a key component of the MFT's SDMP as it tackles the urgent issues of climate change, stakeholder participation, system innovativeness, adaptation, and mitigation measures (NHS, 2018a).

The literature on health system sustainability highlights the importance of a strategic, adaptive, collaborative approach to tackle key issues such as climate change; the MFT has corroborated this perspective in their proposed Climate Change Adaptation reforms. Not only is the MFT aiming to nominate an Adaptation Lead and implement an adaptive perspective within their sustainability governance structure, but the Trust also intends to collaborate with key internal and external stakeholders and partners to deliver their Board-approved CCAP in line with national healthcare guidelines (NHS, 2018a).

Stakeholder involvement relates to the issue of accountability (Fischer, 2015). Through active participation within the MFT's decisions-making processes, stakeholders are able to establish the future trade-offs that they are each required to take on in the movement towards greater health system sustainability (Fischer, 2015). Based on the MFT's proposed reforms, the Trust has demonstrated its awareness of the necessity of gaining stakeholder support in order to mobilise the required changes to be made by all stakeholders within the health system (Fischer, 2015).

Additionally, aligning and implementing the CCAP with the help of national healthcare guidance benefits the MFT by reducing the complications of possibly conflicting stakeholder interests and involvement (Momete, 2016). As the Trust only published their CCAP during 2018-2019, time will tell what benefits are actualised by the Trust as a result of their changes in policy decision-making and formal governance (NHS, 2019).

Within the Climate Change Adaptation module, the MFT also emphasised their recognition of the importance of investing in mitigation and adaptation technologies in the movement towards greater health system sustainability (NHS, 2018a). This perspective shadows what is detailed within the available literature, which expounds how health system sustainability depends greatly on sustained system innovativeness, whether that be technological or scientific innovativeness, in order to remain competitive in the long-term (Fischer, 2015).

Despite expressing an aim to invest in mitigation and adaptation technologies within the SDMP in 2018, the MFT has for the time being achieved limited progress in this area according to the Trust's 2018-2019 sustainability report.

5.2.9. Carbon / Greenhouse Gases

The objective of the SDMP's Carbon / Greenhouse Gas Emissions module is to measure the Trust's carbon emissions, identify hotspots, and take steps to reduce emissions year-on-year (NHS, 2018a). The MFT acknowledges that in order to reduce carbon emissions effectively, a thorough measurement and monitoring process must occur (NHS, 2018a). In order to ensure the successful reduction of its carbon emissions, the Trust intends to set targets, employ new technologies, and engage employees, suppliers, and contractors in the realisation of the SDMP (NHS, 2018a).

5.2.9.1. Carbon / Greenhouse Gases: Proposed Reforms

The MFT proposed an implementation of the following reforms:

- Realisation of environmental gain

    - Calculation and reporting of carbon emissions
    - Improvement of calculation methodology for Scope 3
    - Alignment of targets with the Greater Manchester Climate Change Strategy
    - Delivery of an ambitious annual programme, including carbon reduction projects targeting areas of possible material progress (e.g., pharmaceuticals)
    - Development of a sustainable anaesthesia programme, including reinforcements for raising awareness on the impact of anaesthetic gases on the environment as well as methods of possible reduction (NHS, 2018a)
- Enhancement of health and wellbeing
    - Collaborations with stakeholders to reduce carbon emissions in regard to patient travel and supply chain (NHS, 2018a)
- Readiness for the future
    - Contributions to the Manchester Climate Change Strategy, as well as other city-wide sustainability proposals (NHS, 2018a)
- Delivery of social value
    - Calculation and analysis of carbon emissions due to procurement activities
    - Collaborations with suppliers in regard to sustainability and carbon reduction (NHS, 2018a)

In order to measure the progress made in the Carbon / Greenhouse Gas Emissions module, the MFT would analyse their carbon footprint (as published in their annual report), as well as their carbon footprint in regard to anaesthetic gases per patient (NHS, 2018a).

5.2.9.2. Carbon / Greenhouse Gases: Progress and Actualised Benefits

In order to reach their reduced emission targets outlined by the CCA and GM Environment Plan, the MFT has intensely focused its attention on the monitoring and minimisation of their carbon and greenhouse gas emissions (NHS, 2019). Monthly monitoring of water, waste, electricity, and gas usage in the 2018-2019 year indicated a reduction of carbon emissions by 13% (NHS, 2019).

The Trust also achieved progress in this module through the continued calculation and reporting of their carbon emissions, improving the Trust's methodology calculations for their Scope 3 carbon footprint (i.e., indirect emissions) (NHS, 2019). Further, the MFT indicated a 13.5% increase in available electricity generated onsite from the use of renewable sources, in most part due to the photovoltaic solar panels at the Trust's Wythenshawe Hospital (NHS, 2019).

These actualised benefits were corroborated by the improved 2018-2019 Carbon / Greenhouse Gas Emissions SDAT score of 55.86% (NHS, 2019), compared to 50.45% of the previous year (NHS, 2018b).

5.2.9.3. Carbon / Greenhouse Gases: Evaluation

Similar to the Climate Change Adaptation module, the urgency of carbon emission mitigation is highlighted in the Carbon / Greenhouse Gases module. In order to meet local and national carbon footprint targets, particularly the United Kingdom's Climate Change Act requiring an 80% reduction in carbon emissions and Greater Manchester's goal of carbon

neutrality by 2038, the Trust acknowledges that collective and swift action is necessary (NHS, 2018a).

In the 2018-2019 year, the MFT reduced their carbon emissions relating to water, electricity, waste, and gas usage by 13%, benefitting the Trust in terms of monetary and carbon savings (NHS, 2019). However, this potentially points to a significant lack of progress (at this point in time) in reducing the MFT's Scope 3 emissions, which is the Trust's largest source of (indirect) carbon emissions, most significantly relating to procurement and travel activities (NHS, 2018a). Although Scope 3 emissions (indirect emissions in the value chain) are not directly controlled by the MFT, the Trust has expressed its commitment to include this Scope within its strategy (NHS, 2018a). This also speaks to the necessity of tackling health sustainability challenges using a systemic, holistic approach, taking into account elements that are outside of the open health system (Fischer, 2015).

Additionally, although the Trust has not made tangible progress in regard to carbon emissions relating to pharmaceuticals (an important issue raised within the literature and corroborated by the Trust's SDMP) in the 2018-2019 year, the MFT has expressed that carbon reduction plans on the theme of pharmaceuticals will be achieved within the 2019-2020 year (NHS, 2019).

It is also promising to note that within the MFT's 2018-2019 sustainability report, the Trust indicated the approval of a £10.67 million investment project aimed at replacing ageing energy infrastructure within two of its hospitals (NHS, 2019). The benefits of this project will likely become tangible in the future, especially in the Capital Projects, Asset management and Utilities, and Carbon / Greenhouse Gases modules (NHS, 2019).

5.2.10. Sustainable Use of Resources

The objective of the Sustainable Use of Resources module is to implement an innovative approach to eliminating waste and deliver year-on-year reductions in terms of cost and volumes (NHS, 2018a). The MFT generates vast volumes of waste and carries legal responsibilities to ensure its correct segregation, handling, and disposal. As mentioned previously, the majority of the Trust's carbon emissions lies in its procurement of resources (NHS, 2018a).

In order to ensure a sustainable use of resources, the MFT aims to reduce all unnecessary use of resources across its organisational activities (NHS, 2018a). A shift towards a circular economy approach would be encouraged through the application of a waste hierarchy, the rethinking of traditional waste models, and close collaborations with the MFT employees and supply chains (NHS, 2018a). As such, the Trust and its stakeholders may begin to move away from a throwaway culture.

5.2.10.1. Sustainable Use of Resources: Proposed Reforms

The MFT proposed an implementation of the following reforms:

- Realisation of environmental gain
    - Replacement of single-use products with reusable alternatives when a viable and lower-carbon option is feasible
    - Full transparency when replacement of single-use products is not feasible

    - Delivery of initiatives to reduce food waste, with assistance to ensure treatment in the most sustainable manner
    - Further segregation of waste streams at source in order to improve recycling rates
    - Improvement of recycling facilities at all sites
    - Reduction of materials for final disposal to landfill, in addition to maximisation of material and energy recovery (NHS, 2018a)
- Enhancement of health and wellbeing
    - Implementation of healthy, informed, and sustainable catering choices which meet and exceed national guidelines
    - Implementation of concessions and vending solutions which allow people to make healthy choices more easily (NHS, 2018a)
- Readiness for the future
    - Utilisation of purchasing power wisely, through collaborations with suppliers on the procurement of goods that minimise packaging and offer innovative solutions to waste reduction (e.g., take back schemes)
    - Implementation of a circular economy approach to waste, shifting away from a 'purchase - use - dispose' approach (e.g., purchase of services instead of goods) (NHS, 2018a)
- Delivery of social value
    - Development of sustainable catering policies, including only accepting collaborations with suppliers who meet requirements
    - Promotion of a reuse and refurbishment culture for items when possible and cost-effective, instead of purchasing new

- Adoption of whole life cycle approach to purchasing
- Application of higher weighting for social value in the procurement of goods and services
- Collaborations with major suppliers towards increased sustainability (NHS, 2018a)

In order to measure the progress made in the Sustainable Use of Resources module, the carbon footprint for the MFT's procurement of goods and service would be calculated (NHS, 2018a). In addition, the MFT would analyse the waste streams and volumes of its facilities (NHS, 2018a). Finally, the number of suppliers with whom the MFT actively engages in regard to improving sustainability would be calculated (NHS, 2018a).

5.2.10.2. Sustainable Use of Resources: Progress and Actualised Benefits

With procurements contributing most significantly to the MFT's carbon footprint, the Trust continued to emphasise the urgent need for sustainable purchasing and use of resources within their 2018-2019 report, shifting towards efficient procurement and away from throwaway culture and unnecessary waste (NHS, 2019). As a result of their efforts in this module, the Trust experienced a 3.7% increase in recycling weights, a decrease in landfill waste by 7.4%, and a decrease in incineration waste by 5.4% (NHS, 2019).

The MFT's two most extensive healthcare facilities, Oxford Road Campus and Wythenshawe Hospital, experienced the implementation of a public area recycling measure that segregated food waste, cans, plastic, paper, magazines, and coffee cups (NHS, 2019). The Trust also collaborated with

a recycling company to shred redundant clinical uniforms and use the subsequent materials to fill mattresses (NHS, 2019).

Further, the MFT took part in a UK-wide take-back scheme with RecoMed to recycle PVC masks and tubing used in operating theatres (NHS, 2019). The Trust additionally achieved progress in this module through the implementation of a decluttering project intending to streamline hospital departments of unnecessary items, reaching over 330 staff members and increasing use of the Warp It resource distribution network (NHS, 2019).

The MFT's SDAT score in the Sustainable Use of Resources module improved from 52.78% (NHS, 2018b) to 58.33% in the 2018-2019 year (NHS, 2019).

5.2.10.3. Sustainable Use of Resources: Evaluation

The Sustainable Use of Resources module tackles numerous health system sustainability challenges, notably the increasing and unnecessary use of single-use disposals within the healthcare setting (Fischer, 2015). The literature on health system sustainability makes a case for take-back systems and reusable alternatives as a means of mitigating the use of single-use disposals (Fischer, 2015). The SDMP's Sustainable Use of Resources module highlights the same issues and proposes similar mitigation strategies (NHS, 2018a).

Although the Trust achieved progress in this module and experienced benefits such as those listed previously, there are still considerable advancements to be made, especially when taking into account the MFT's central goals for this module.

During 2018-2019, information on any tangible progress regarding single-use disposables, food waste initiatives, and sustainable catering choices, for example, was lacking (NHS, 2019). However, within the MFT's 2018-2019 sustainability report, an indication to further tackle the issues of single-use disposables, waste management, and recycling the following year was presented (NHS, 2019).

5.3. Expert Opinions: Dr Willi Haas

After having been briefed on the case study and queried as to his expert opinions on the situation, Dr Haas began by noting the dire circumstance of Manchester, a city with one of the worst public health statuses within Europe (personal communication, February 20, 2021).

Manchester's population experiences an estimated life expectancy of 74.8 years, the lowest of any local authority area in England and Wales for women, placing it within the United Kingdom's top ten areas facing the lowest life expectancy (Purdam, 2017). In comparison, the general life expectancy within the United Kingdom is an estimated 81.5 years (Purdam, 2017). The differences in life expectancies across the United Kingdom has been described as a human rights issue (Purdam, 2017).

Interrelated factors linked with lower life expectancies include low income, local environment, access to healthcare, employment status, diet, exercise, housing, smoking and alcohol consumption levels, social status, and social isolation (Purdam, 2017). Within the United Kingdom, the most common causes of death are circulatory diseases, cancer, respiratory diseases, dementia, and Alzheimer's disease (Purdam, 2017).

It is also significant to note the industrial history of certain areas within the United Kingdom, including Manchester, notably in relation to employment conditions where long-term health impacts, such as chronic lung disease, are common (Purdam, 2017). Additionally, the relevance of ethnic populations within these areas are important, as distinct ethnic populations possess differing health profiles and face additional barriers to health services as a result (Purdam, 2017).

Greater Manchester became the first English region to receive control of £6 billion of health and social care funding from the central government in 2016 (Purdam, 2017). This devolution of health funding highlights the great health inequalities experienced across Greater Manchester and the need for a shift towards tackling long-term inequalities in life expectancy and healthy living to take place (Purdam, 2017).

Dr Haas' first concerns are the main causes of Manchester's poor public health status and, aside from further fostering sustainable treatment operations, what role the NHS plays in mitigating these conditions (personal communication, February 20, 2021). Further, Dr Haas reiterates that as long as health treatment is understood in the context of repair medicine, improvements in sustainability are limited, as the NHS case shows (personal communication, February 20, 2021).

Health promotion requires major improvement in all settings, such as drastically increasing active mobility amongst people in order to foster greater health and reduce environmental impact (W. Haas, personal communication, February 20, 2021). This, in turn, will reduce the number of

people requiring treatment within hospitals (W. Haas, personal communication, February 20, 2021). Similarly, with nutrition, healthier food choices decrease the risk of numerous diseases (W. Haas, personal communication, February 20, 2021). Dr Haas emphasises that these themes are grand (social and environmental) justice issues (personal communication, February 20, 2021).

The NHS included an intended health promotion reform within their SDMP, specifically within the Corporate Approach module:

- Public health promotion and community service through support of the Manchester Local Care Organisation (MLCO) (NHS, 2018a)

However, the follow-through of this goal seems to be lacking somewhat (at this point in time). Within the MFT's 2018-2019 sustainability report, no progress on this specific reform was indicated (NHS, 2019). A section within the Corporate Approach module (regarding progress to be made in the following year) detailed the Trust's intention to work closely with the MLCO on sustainability and environmental initiatives (NHS, 2019). While "health promotion" was explicitly detailed in the original goal, the intention would seem to be broader now, having shifted to "sustainability and environmental initiatives". However, this may simply be a case of altered phrasing, and only time will showcase the MFT's progress in this sphere.

Additionally, the issue of nutrition and healthier food choice is also present in the MFT's SDMP, within the Sustainable Use of Resources module:

- Implementation of healthy, informed, and sustainable catering choices which meet and exceed national guidelines

- Implementation of concessions and vending solutions which allow people to make healthy choices more easily (NHS, 2018a)

These reforms, however, would seem to be geared towards stakeholders within the MFT's facilities (such as employees and patients) rather than (Manchester's) society as a whole. While certainly benefitting specific stakeholders, these improvements would probably not sufficiently tackle the larger health sustainability challenge of disease prevention and health promotion, the social and justice issues presented by Dr Haas.

At the core of healthcare lies treatment, and Dr Haas puts forward that in fostering sustainable healthcare, the question of how to reorganise the NHS' core (i.e., treatment) remains (personal communication, February 20, 2021).

Challenges in treatment include misallocations and unnecessary medication, for example, and suggests a need to consider how treatment carriers for patients could be organised using a patient-centred rather than hospital-centred approach (W. Haas, personal communication, February 20, 2021). Within his studies, Dr Haas has examined that environmental impacts depend more on the setting (e.g., Intensive Care Unit (ICU)) rather than a patient's health status (personal communication, February 20, 2021). This focus, Dr Haas reiterates, is missing (personal communication, February 20, 2021).

The MFT's procurement activity, Dr Haas additionally notes, is a significant issue and one of the Trust's largest contributors to its high footprint (personal communication, February 20, 2021).

The MFT has, however, indicated an intention to overcome this issue in their SDMP. A goal within the SDMP's Corporate Approach module states the following:

- Development and delivery of a sustainable procurement strategy (NHS, 2018a)

Similar to previous critiques, no explicit mention of progress in developing a sustainable procurement strategy was detailed in the 2018-2019 report, although there were mentions of (potential) progress relating to procurement in a much more general sense, such as contributing to developing healthcare sector commitments and collaborating with partners to implement climate change actions across Health and Social Care organisations in the region (NHS, 2019). Since the 2018-2019 report is looking at progress made only a year after the release of the MFT's SDMP, it's possible that additional benefits could be achieved by the Trust in the future, provided the strategy's perspective remains focused on tackling the root issues of health system sustainability.

In a summarising conclusion of the MFT's SDMP, Dr Haas believes that the Trust's strategy is pragmatic, well-developed, and perfect in regard to issues that are not central to healthcare, such as building, transport of patients, caring for own staff, and so on (personal communication, February 20, 2021). However, Dr Haas' critique on the broader picture, or lack thereof, remains (personal communication, February 20, 2021).

6. Conclusion

Addressing the limitations of this study is significant in order to highlight the threshold of its findings and assist readers in determining how best to apply these findings to future research. Due to the recent implementation of sustainability reforms within health systems, the availability of associated literature and data (notably pertaining to the MFT's progress) was significantly preliminary. This lack of detailed progress data points to an opportunity for further research avenues in the sphere of actualised health system sustainability benefits once additional data is made available.

The limited availability of data, which covered a significantly short period of time, also points to the limitations of this paper's case study time scope, which, although beneficial in providing a clear and realistic timeframe for this study, likely did not allow for an extensive analysis of the effects of implementing sustainability reforms within a health system. To satisfactorily answer any question pertaining to the implications of implementing sustainability reforms within health systems, the undertaking of a longitudinal study spanning years or possibly decades of data would likely be required.

The potential benefits of increased sustainability within health systems include enhanced public health, climate resilience, environmental quality, employee morale and engagement, social cohesion, and cost management. This research paper sought to identify whether and to what extent health systems (within Europe) have realised these benefits in the movement towards greater health system sustainability.

Given the nature of healthcare and its subsequent detriment to the environment, societies, and national economies, it would seem essential to adopt sustainability reforms within health systems in order for them to remain viable in the long run. Having said that, the shift towards greater health system sustainability is not without its challenges.

Barriers to health system sustainability (within Europe) include an ageing population, technological advancements, lack of awareness and psychological barriers among health workers, organisational hurdles, resistance to change, power struggles, ulterior motives, weak governance and enforcement, and inadequate regulatory frameworks.

The pathways to overcoming these barriers and successfully transitioning towards improved health system sustainability involves marked intervention in the spheres of quality, national planning, long-term vision, innovation, disease prevention, health promotion, environmental concerns, (in)efficiencies, stakeholder collaboration, transparency, institutional accountability, and individual responsibility.

The best-practice case study of the Manchester University NHS Foundation Trust demonstrates that progress in the shift towards greater health system sustainability is remarkably gradual, whether due to the challenges posed by the barriers highlighted above or an absence of appropriate pathways needed to ensure effective health system sustainability. Subsequently, any environmental, social, and financial benefits resulting from improved health system sustainability would materialise gradually as well.

Since the implementation of its SDMP in 2018, the MFT has reduced its total energy usage, improved energy efficiency, shrunk costs, enhanced working conditions and (green) building design, witnessed positive behavioural changes among employees, improved patient and employee wellbeing, strengthened the quality of its employees, and significantly increased carbon and monetary savings.

The extent of the benefits gained by the MFT were not always clear. On the other hand, for having been only recently implemented, the SDMP has to-date garnered the Trust significant benefits and improvements in the transition to greater sustainability, especially in regard to (carbon) emission mitigation. It would almost certainly be expected for the Trust's system to garner additional benefits as further progress on its SDMP is achieved.

The progress that would need to be achieved in the coming years to meet the goals of the Trust's SDMP are vast. However, the literature on health system sustainability indicates that the continued attainment of benefits and perseverance of problem resolution is what ultimately leads to greater health system sustainability.

The objectives set out within the MFT's SDMP and the benefits gained thus far as detailed in the follow-up report would seem to, for the most part, and realistically to some extent, play in the interest of the Trust (notably its patients, employees, and visitors) and its Estate, rather than the community, environment, and economy (of Greater Manchester) as a whole.

This skewness may point to the necessity of further (long-term) intervention by local policymakers and improvement of public health frameworks in the

transition to improved health and subsequent health system sustainability, especially in regard to (social and environmental justice) issues involving health protection and promotion, disease prevention, nutrition, environmental protection, individual and organisational responsibility, equality, and access. The importance of policy in the transition to greater health system sustainability was demonstrated in the case study as the MFT initially sought to mitigate their detrimental impact due to an increasing pressure of legal obligations by the United Kingdom's Climate Change Act.

A potential shortfall within the MFT's approach, made evident by its SDMP and follow-up report, involves a lack of community disease prevention and health promotion prioritisation, an issue at the forefront of health system sustainability. As long as the root challenges of health system sustainability (i.e., disease, health, food choices) are not tackled, and healthcare remains a reactive repair process, it would seem unlikely for any health system to achieve sustainability successfully.

A proactive approach to healthcare involving disease prevention, health promotion, high-quality counselling, low-impact diagnosis, and appropriate allocation of medication and treatment options would seem, from the available literature and the expert opinions of Dr Haas, necessary for the transition towards greater health system sustainability. Without this perspective, improvements in health system sustainability appear limited and as such, reaching the full potential of benefits offered by sustainable health systems is also presumably limited.

On that account, the (European) transition to greater health system sustainability appears preliminary and has demonstrated the gradual and

partial realisation of promising benefits as a result of progress achieved so far. These benefits and their future potential would seem limited to a great extent, however, owing to a potentially lacking approach in regard to the ultimate fostering of health and prevention of disease. These limitations could likely dissolve in the future if core sustainability challenges within health systems are tackled further.

Harnessing the full potential of societal, environmental, and financial benefits as a result of improved health system sustainability would strongly seem to require the sustained application of a proactive, inclusive, and transparent approach in tackling not only surface-level but, importantly, root issues of healthcare and, ultimately, health.

7. References

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