Models of sustainability? A comparative analysis of ideal city planning in Saltaire and Masdar City.

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Abstract

This report compares the model English industrial town of Saltaire to the recently proposed Masdar City eco-city development in the United Arab Emirates. Despite their different contexts, there are significant issues of ecological, social and economic sustainability that are common to both cities. These parallels raise important questions about the notion of 'sustainability', the viability of imposed planning regimes, and the relevance of model cities to the Australian urban environment. Ultimately, this report demonstrates that the perceived level of sustainability varied greatly according to the methods of analysis used and the contextual and ideological values inherent in these methods.

Key words: urban planning, sustainability, model city, eco-city, ecological footprint, bioregionalism.

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Introduction

In past times and today, cities have been human societies' main sites of wealth, innovation and progress (Hall 1998). Therefore in a symbolic and a practical sense, urban design and planning has taken on great importance with regard to defining identity, sustaining development and addressing the most pressing challenges of any given era. These functions of the urban environment are especially salient and amenable to analysis within the model planning schemes of the past, as well as their modern conceptual equivalent, the 'eco-city'. This report will compare the model English industrial town of Saltaire to the recently proposed Masdar City eco-city development in the United Arab Emirates, assessing the sustainability of these settlements and their potential applications to sustainable urban development in present day Australia.

Saltaire

Saltaire was established in the mid-nineteenth century by Titus Salt, who was a prominent textile mill owner and 'industrial philanthropist' in the English city of Bradford. Located five kilometres outside of Bradford, the town was focused around the monumental Salt's Mill, which at the time of construction was one of the largest and most technologically-advanced woollen mills in the world. Saltaire's population of

approximately 10,000 people was mainly composed of mill workers and their families. Most resided in a collection of 850 purpose-built houses of remarkably high quality relative to the appalling conditions typical of the era. The Saltaire was additionally notable for its physical amenity and uncommon focus on the physical and moral welfare of its workers. In 2001, the entire town was granted UNESCO (United Nations Educational, Scientific and Cultural Organization) World Heritage status in recognition of its significance as an 'ideal' model industrial town (Lynch 2006, p. 52).

Masdar City

Masdar City is a recently proposed eco-city, to be located in the vicinity of Abu Dhabi in the United Arab Emirates. It is a project of Abu Dhabi's state-run Masdar Corporation, in partnership with *Foster + Partners*, a prominent British architecture firm. The purpose and character of Masdar City is well encapsulated by its official vision statement:

> Masdar City will house around 1,500 clean-tech companies, with 40,000 residents and 50,000 commuters, providing a research and test base for renewable energy technologies. It will be an exemplar of environmental best practice, a demonstration of what is possible and a wonderful place to live and work. (Masdar City 2009)

Masdar City's design is based on a fusion of the traditional Arabic walled city with innovative modern architecture. Key buildings such as the centrepiece 'Masdar HeadQuarters' will employ active and passive design features to collect and moderate the solar, wind and water resources of the desert surrounds Construction commenced in late 2008 and the first phase of the project is expected to be completed by 2013.

Rationale and remarks on the choice of cities

While superficially very different, these model cities share an underlying purpose: to provide innovative solutions to the problems associated with social and industrial progress. For Saltaire, this meant providing an alternative to the squalid living and working conditions of nineteenth century industrial England and especially its 'parent' city of Bradford. In a parallel sense, Masdar City is presented as a solution to the equally pressing current problems of resource depletion and climate change – to which the oil-dependent emirate of Abu Dhabi is a prime contributor.

Despite differences between Saltaire and Masdar City owing to their disparate spatial and temporal contexts, some interesting and informative parallels can be identified. Firstly, both cities were planned unilaterally by private interests, rather than developing organically or as a result of direct government policies. Whether based on Titus Salt's entirely private milling operations or the more centrally-affiliated Masdar Corporation, the key point is that these cities emerged from outside the conventional planning process. Secondly, both Saltaire and Masdar City can be viewed as 'concept cities': urban settlements with specialised functional foci and deliberately constructed cultures of place. In this case, the textile milling and green technology industries – considered to be 'state-of-the-art' in their respective eras – are the dominant features of not only the cities' productive output, but also of their overall identities. This focus on new technology raises another important point: unlike most cities, the everyday functional benefits of Saltaire and Masdar are arguably secondary to their demonstrative value as experimental 'showcases'.

Overall, it is clear that Saltaire and Masdar City have various notable features which set them apart from ordinary urban settlements. As this paper will discuss, this distinctiveness will have implications for their own sustainability and the extent to which their ideas can be transferred to the Australian context.

Methodology: Criteria for Urban Sustainability

In order to come up with a set of criteria for urban sustainability, it is first necessary to settle on a definition of what 'sustainability' actually means. Despite (or perhaps because of) the term's frequent popular usage, this is not an easy task. The oft-quoted statement of the World Commission on Environment and Development – that sustainable development '*meets the needs of the present without compromising the ability of future generations to meet their own needs*' (WCED 1987) – is a useful starting point, however it leaves many key questions unanswered (McManus 2005, pp. 72-74). For example, it gives no indication of how the various aspects of sustainability should be prioritised: are we attempting to sustain the planet's ecosystems, economic growth, or perhaps a degree of social and cultural wellbeing? Are these stocks of natural, produced and social capital of equal importance and able to be substituted for each other (Figure 1)? Or do these three types of capital exists in a hierarchical and non-interchangeable relationship, which holds that natural capital is paramount and cannot legitimately be diminished for economic gain (Figure 2)?

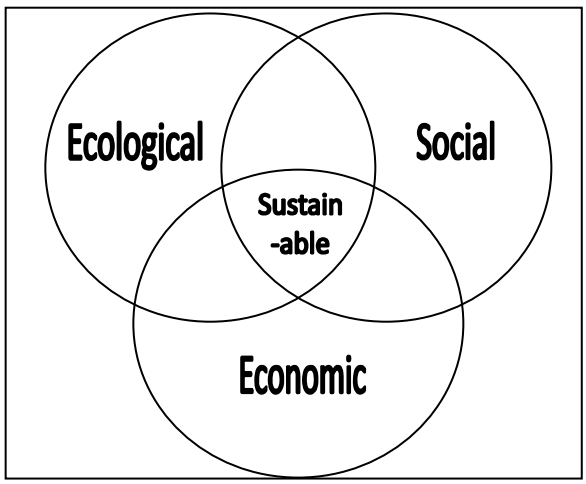

Figure 1: *Balanced 'Weak Sustainability': equal weighting of the three components; which can be inter-converted.*

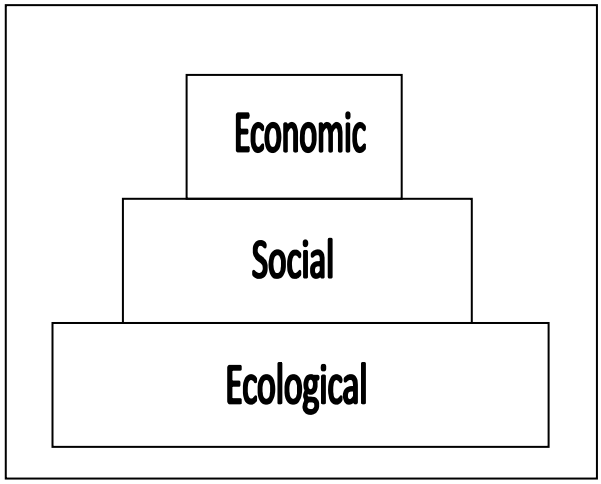

Figure 2: *Hierarchical 'Strong Sustainability': ecology is prioritised; components cannot be inter-converted.*

In addition to these more general questions, the choice of Saltaire and Masdar City raises some more specific issues to be considered when formulating a suitable set of criteria. Firstly, there are inherent challenges in evaluating a city like Saltaire according to modern concepts of sustainability, as it existed in an era where social, economic and environmental relationships were perceived very differently. Thus, the chosen criteria had to be adaptable enough to allow for this difference in context. Secondly, the meticulous, unilaterally-imposed planning regimes of the two cities made the question of *governance* sustainability highly relevant. While issues of urban governance and planning powers might often be considered as subordinate aspects of 'social sustainability' or mere administrative concerns, in this case it seemed appropriate to

elevate these issues by considering the 'social and governance sustainability' of Saltaire and Masdar City. Finally, it should be acknowledged that the exercise of devising urban sustainability criteria relies on a basic assumption: that a 'sustainable city' is possible, and is not a contradiction in terms as canvassed by Rees (1997) and Girardet (1999).

With reference to all of these issues, a set of primary and secondary criteria were developed. Figure 3 schematically represents the relationship between these criteria.

Primary Criteria – Three Aspects of Sustainability:

1. Ecological sustainability, primarily assessed according to two prominent ideas in this field:
    1.1. Ecological footprint analysis
    1.2. Bioregionalism
2. Social and governance sustainability
    2.1. Population wellbeing and demographic balance
    2.2. Urban governance and social control
3. Economic sustainability, assessed according to neoliberal capitalist and Marxist-socialist perspectives.

These three aspects have been organised according to a hierarchical notion of 'strong sustainability', for a few reasons. Firstly, this investigation examines two *ideal* model cities which aim to challenge mainstream conventions – therefore the more radical idea of 'strong sustainability' is the most rigorous and appropriate framework for analysis. Secondly, the idea of substituting between natural and produced capital is problematic, because it is often a 'one-way' conversion: the natural environment can be readily exploited for material benefit, but even with great economic input, it may be difficult or impossible to restore a degraded ecosystem to its original condition (Ayres, van den Bergh and Gowdy 1998, pp. 3-4). Furthermore, a hierarchical relationship is appropriate because it recognises that our society and economy are ultimately dependent on the natural environment, whereas the natural environment can (and for all of prehistory, did) exist regardless of these other aspects. In accordance with this approach, this paper will devote the greatest proportion of its analysis to ecological sustainability.

A key methodological challenge was to account for the very different values and knowledge levels present in Saltaire and Masdar City, while still producing results that were consistent and relevant to the discussion of urban sustainability in present-day Australia. To address this issue, the three aspects of sustainability were applied in two ways: primarily according to today's ideas of sustainability; but also giving some weight to the issues that were perceived as being the most problematic and important in their original contexts.

Secondary Criteria

The function of these criteria is to variously enhance and mitigate the sustainability conclusions of the primary criteria. They are intended to supplement the critical analysis of this paper, and also to enable the three generic aspects of sustainability to be more closely fitted to the unusual situations of Saltaire and Masdar City.

A. Establishment Costs: the detriment to sustainability that will arise from building the new city from scratch, as opposed to pursuing a business-as-usual scenario within existing urban settlements.

B. Experimental Benefits: the city's function as a demonstrative 'showcase' may to some extent counterbalance establishment costs and other disadvantages.
C. Flexibility of the Urban System: the city's ability to adapt to (both gradually and suddenly) changing circumstances.

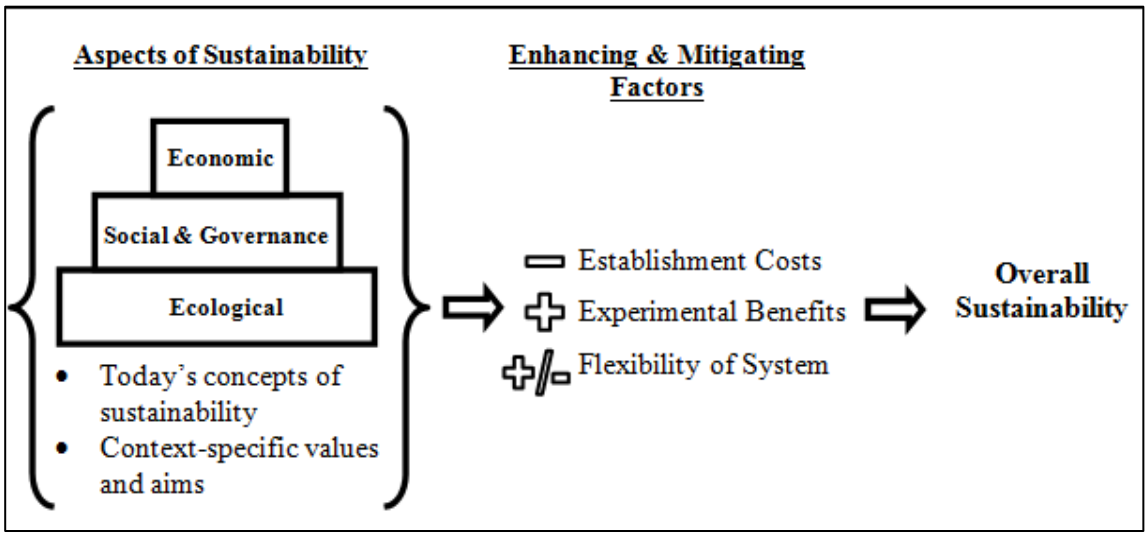

Figure 3. *A visual representation of the criteria and how they interrelate.*

Results and Discussion

1 – Ecological Sustainability

1.1 - Ecological Footprint Analysis

As set out by Wackernagel and Rees (1996), the 'ecological footprint' can assess a given city's sustainability by measuring the various goods, services, energy and land which it consumes. This information is used to determine the city's 'appropriated carrying capacity': the total ecosystem area that is needed to support its existence.

The principles of ecological footprint analysis can provide an interesting conceptual guide to Saltaire's ecological sustainability, even though a quantitative overall 'score' cannot be produced due to the lack of data. If a population's consumption of resources (and thus its ecological footprint) is taken to be roughly proportionate to its standard of living, then Saltaire's population of 10,000 would have had a larger footprint than 10,000 people living in the squalor of neighbouring Bradford, yet a yet a much smaller footprint than the same number of people living in present day England. These consumption patterns are consistent with the level of access to basic resources: Saltaire's houses had basic water and gas outlets, as opposed to the distinct lack of utilities provided for the ordinary workers of Bradford (BBC 2009), and compared to the plentiful water, gas, electricity and sewage connections of the present day. Therefore at face value, a footprint analysis indicates that the famously 'clean' town of Saltaire was less ecologically sustainable than the notoriously filthy slums of neighbouring Bradford.

On closer examination, this result can be actually attributed to the imperfect application of modern ecological priorities to a nineteenth century situation. The modern tool of footprint analysis focuses on resource *consumption* rather than visible pollution *output*, which is understandable because resource scarcity is a bigger issue than visible 'filth' in today's context. The incongruous result occurs because the nineteenth century's priortities were actually reversed: there was less emphasis on *consumption* because resources were relatively plentiful, and more emphasis on the uncontrolled *outputs* of visible pollution such as smoke, garbage and effluent. However, it should be noted that smoke itself was of mixed significance in nineteenth century industrial England: despite its unhealthiness, it was also a symbol of prosperity and employment.

In contrast, the ecological footprint idea can be applied much more readily to Masdar City. The city has in fact adopted the footprint-based 'One Planet Living' concept (WWF International and BioRegional 2009) as one of its central organising principles (Masdar City 2009a). The 'One Planet Living' ecological footprint has ten components: carbon emissions; waste; transport; materials; food; water; habitats and wildlife; culture and heritage; equity and fair trade; and health and happiness. The United Arab Emirates scores especially poorly on these criteria: if everyone lived like the residents of Abu Dhabi and Dubai, six planets would be required to support the global population (Masdar City 2009a). Thus, Masdar City must radically depart from the business-as-usual scenario if it wants to reach the goal of requiring only one planet to support its population's lifestyle.

If the plans detailed on the city's official website (Masdar City 2009) are successfully carried out, this transition to ecological sustainability will probably occur. However, it could equally be argued that these plans for 100% renewable energy, zero waste and a carless transport system are unrealistic, and are also inconsequential unless the remainder of Abu Dhabi's 4.7 million 'large footprint' residents follow Masdar City's lead (The Electricity Journal 2009). In the short to medium term, this radical change seems unlikely. However in the long term, as the region's oil reserves inevitably dwindle, economic and energy security imperatives might actually force such a transition to more sustainable practices. On this basis, Masdar City could be viewed quite favourably, not as an end in itself but instead as the forward-thinking pilot project for Abu Dhabi's eventual transition to a post-carbon society. Indeed, this is exactly how Masdar City's Chairman and CEO represent the project (Masdar City 2009c).

As a country which is similarly very dependent on fossil fuels, it would be desirable for Australia to replicate this scheme of a renewable energy pilot project contained within a long term strategic vision. An Australian pilot eco-city – probably on a smaller scale than Masdar City – could be located in an area such as the Hunter Valley, which may currently be on the cusp of its own transition from a 'carbon valley' to a 'post-carbon society' (Evans 2008). Like Masdar City, this Australian eco-city could take advantage of locally-available renewable energy sources (probably solar thermal, photovoltaic and wind power in this case), retrain former coal and steel industry workers, and form partnerships with businesses and higher education providers within the region. However, a project of this type should be careful not to overly rely on the principle of 'physical determinism' as Masdar City arguably does. That is, it must be recognised that people's individual and group behaviours may not automatically become more sustainable just because they are placed in an 'eco-friendly' built environment – 'soft' social policies and incentives are needed to complement the 'hard' infrastructure and

administration (see, for example, Johnson 1977, Leidenberger 2006). As concisely stated by Rees (1997, p. 309), 'the best-designed and most sensitively administered city cannot be sustainable if its inhabitants live unsustainable lifestyles'.

1.2 - Bioregionalism

Bioregionalism is about living within the local limits of nature, in a self-reliant way which emphasises a belonging to place and spatially divides land based on physical rather than political features (McManus 2005, p. 66). A bioregionalist approach would take a positive view of Saltaire's provision of local employment, housing and water supplies, as well as the sourcing of local stone for the majority of the buildings (BBC 2009). The town's apparent ability to forge its own development path, independent of the wider Bradford region, would also be significant (Gray 2007, p. 796). However on a more fundamental level, Saltaire developed in a manner entirely contrary to bioregionalism. Saltaire's economic basis, and indeed its very existence, can be attributed to the evolution of textile manufacturing from a locally-based cottage industry to a global exercise in mass production and trade. From bioregionalist perspective, this transition from local economic activity and resource use to large-scale industrial production would be deemed ecologically unsustainable (Gray 2007, p. 797). It would be criticised for disregarding ecological limits and severing the intrinsic connection between people and their natural environment (Gray 2007, p. 791). As a subsidiary of the transnational corporation-hosting, expatriate haven of Abu Dhabi, Masdar City would be located even further along this trajectory of globalisation and would therefore be considered even more unsustainable from a bioregional perspective.

While this bioregional assessment may have theoretical merit, it presents practical problems if taken at face value. For example, if Saltaire was to be declared unsustainable simply because of its industrial character, then by extension, bioregionalism could be expected to oppose the whole arc of development and globalisation that was initiated by the industrial revolution and has culminated in places like Masdar City's 'parent' city of Abu Dhabi. This does not fit with historical reality, a point which is echoed by Harvey's (1996) critique of bioregionalism as being backward-looking. It also offers no indication of how Saltaire's and Masdar City's ecological sustainability could be improved, short of completely reorienting their economic bases.

Accordingly, in order for bioregionalism to be of practical relevance to these cities – and indeed to modern Australia – it must usually be applied moderately and selectively rather than strictly and fundamentally. For example, while some elements of bioregionalism will be useful for managing the Murray-Darling river catchment, or encouraging regional identity and 'practical bioregionalism' in an area such as Armidale (Gray 2007), more fundamental applications will probably be restricted to isolated examples within so-called 'alternative' communities.

Establishment costs and experimental benefits?

The above assessments of ecological sustainability are made with one important qualification. Since Saltaire and Masdar City are in the unusual situation of being built entirely 'from scratch', conventional measurements which focus on *ongoing* sustainability may not provide the full picture. In order to complete the analysis, it is necessary to account for the initial costs of building the new cities, as compared to pursuing a business-as-usual approach within existing urban areas.

Due to the high ecological impacts of materials like aluminium and concrete (Heathcote 2008), as well as the energy required for transportation and setup, the establishment phase of a new settlement will almost always be 'unsustainable' in itself. The key question is: can these initial ecological costs be justified by the subsequent savings in energy and resources? Or, despite the glamour and inspiration of building a totally new city, will it always be more worthwhile to simply convert existing cities to more sustainable practices? Some commentators, such as Heathcote (2008) and Nair (2008) are adamant that the latter view is correct. For example, Nair brands the eco-city project as a 'superficial, high-technology fix' which serves as a 'distraction' from more straightforward and effective measures. On this basis of these views, it would be concluded that Saltaire and Masdar City are inherently unsustainable.

While acknowledging that building 'new' cities might be unsustainable under certain conditions, supporters of Saltaire and Masdar City would argue that this conclusion is by no means inevitable. In Saltaire's case, it could be said that business-as-usual development was simply not an option, due to the booming economy and population, and the futility of trying to 'improve' Bradford's dilapidated housing stock and Titus Salt's five existing factories. In Masdar City, the ecological costs of initially establishing the city could potentially be minimised by using environmentally-friendly building materials, restricting water use and offsetting unavoidable carbon emissions. According to the available project information (Masdar City, 2009a), these strategies are being pursued at least to some extent. For example, all materials used must have a minimum of 30% recycled content. Materials must also be 'responsible' – appearing on the 'Zero Masdar Restricted List Materials' – although it is unclear exactly what this entails. Water consumption is to be 30% lower, and carbon emissions 50% lower, than for business-as-usual construction practices (Masdar City, 2009a). Disappointingly, however, Masdar City's showpiece policies of 'Zero Carbon' and 'Zero Waste to Landfill' are not scheduled to come into force until after the final phase of construction has been completed (Masdar City, 2009). There are various mentions of carbon and waste offsets, however it is not certain whether these programs will fully cover the relevant 'sustainability gaps'.

Despite these quantitative uncertainties, Masdar City's general ideas of ecologically sustainable construction could be widely applicable to the Australian context. Ideally, all new building work – especially large scale developments such as office towers, business parks and new suburbs – should be required to meet the standards set by Masdar City. This is an example of the great potential to replicate *individual elements* of the eco-city, and thus to enable the influence of the eco-city concept to spread far beyond the relatively few situations in which the entire model can be replicated.

Finally, a moderate lack of sustainability during the initial construction phases of Saltaire or Masdar City (or indeed any similar model city) would arguably be justified by the projects' wider demonstrative value as an experiment and a showcase of best practice. For example, if the success of Masdar City's revolutionary 'Personal Rapid Transit' system encourages ten existing cities (for example the Sydney or Melbourne CBD) to adopt similar carbon-free systems, then the initial ecological costs will be recovered more readily. An even greater demonstrative benefit would occur if Masdar City were to push urban ecological outcomes further into the mainstream, thus helping to turn today's 'best practice' into tomorrow's 'standard practice'. Alternatively, if a

certain aspect of Masdar City does not operate as planned, then this is still experimentally valuable: the lessons learnt can be used to improve the sustainability of future projects, including those which might occur in Australia's cities.

2 – Social and Governance Sustainability

Saltaire and Masdar City are both model settlements built from scratch, which couple 'ideal' conditions with strictly imposed development plans. As a result, these cities actually raise similar issues of social and governance sustainability, despite their different temporal and cultural contexts. These issues fall into two distinct categories: firstly, relating to population wellbeing and demographic balance; and secondly, relating to urban governance and social control.

2.1 - Population wellbeing and demographic balance

In terms of quality of life and population structure, Saltaire was definitely more socially sustainable than its 'parent' city of Bradford. The everyday living conditions compared very favourably to what was experienced in other industrial cities and towns: the streets were clean, there was less overcrowding and disease, and the workers were housed generously (Lynch 2006, p. 52). The public almshouses and a hospital provided basic care for the poor, sick and elderly, in an era before such social services were widespread (BBC 2009). Despite the lack of quantitative data, descriptive accounts imply that Saltaire's population had a higher life expectancy and lower infant mortality rate than the population of Bradford (see, for example, BBC 2009). Given that Bradford's life expectancy had dropped to a mere 18 years and one in two babies born did not reach their sixth birthday (Lynch 2006, p. 51), it is not hard to identify the imperative to create a healthier and more balanced (and thus more sustainable) society in Saltaire. It should be noted that Saltaire's healthier and less polluted physical environment would have greatly contributed to this social sustainability. This relationship illustrates the validity of the hierarchical 'strong sustainability' model, which suggests that social sustainability cannot exist without an ecologically sustainable foundation.

It is difficult to judge Masdar City's potential for social and demographic wellbeing before the city has been built. Nevertheless, the city's location within the wealthy United Arab Emirates indicates that – unlike in Bradford and Saltaire – basic quality of life issues will not be a constraint to social sustainability. In terms of demographics, it is possible that the population composition of Masdar City may be somewhat atypical due to its specialised high-tech industries, its hosting of the International Renewable Energy Agency (IRENA) and the UAE's large migrant and 'expatriate' workforce. However this has not been a major constraint to social sustainabililty elsewhere in the UAE, therefore problems are not anticipated in this case.

2.2 – Urban Governance and Social Control

Saltaire and Masdar City's unusual character, as pre-planned model towns, has interesting implications for the sustainability of their urban governance and planning powers. One of Saltaire's most distinctive features was its paternalistic governance structure, which was enabled by the unilateral design and development of the town. As the founder, dominant employer and de facto 'leader' of Saltaire, Titus Salt exercised his considerable power to oversee the entire town's planning. Salt's personal choices could be found everywhere, from the Italianate mill design to the presence of churches and almshouses and the absence of a public bar (BBC 2009). Further, Saltaire's population of workers would have had very little agency or self-determination of their

lifestyles: moving into pre-built houses and attending allocated jobs in Salt's Mill. While Masdar City's planning and lifestyle choices are not controlled by a single person, these urban decision-making processes still appear to be more concentrated and less pluralistic than usual. In fact, a high level partnership between the state-affiliated Masdar Company and the British architecture firm *Foster + Partners* is responsible for the majority of the design process.

In both Saltaire and Masdar City, the complete 'newness' means that there is no pre-existing population for the usual processes of community consultation. This renders the planning process less democratic and more 'imposed from above'. It can be convincingly argued that this unilateral, pre-determined urban governance is socially unsustainable and inflexible to change over time (Johnson 1977, p. 26). Furthermore, if seen through the lens of Michel Foucault's social theories (see, for example, McKinlay 2006), the orderliness and high visibility of these model settlements may be indicative of negative *control* rather than positive *openness*. This paper acknowledges this as a major potential shortcoming of model settlements like Saltaire and Masdar City. Nevertheless, this point is not absolute. As explained by Leidenberger (2006, p. 463), there will always be a tension in the field of urban planning: between fragmented democracy and plurality on one hand; and the effective yet authoritarian imposition of an integral planning vision on the other hand.

3 – Economic Sustainability

Saltaire's persistence as a mill town for over a century could be cited as *prima facie* evidence of its economic sustainability. From a neoliberal capitalist perspective, Saltaire was certainly successful, as defined by its ability to maintain production and profit even with the many social and economic changes occurring around it. The high quality of 'Alpaca Orleans' worsted cloth produced at Salt's Mill would have contributed to this, by providing Saltaire with an economic niche (Lynch 2006, p. 52). This may have enabled Saltaire to continue production late into the twentieth century, at a time when the majority of mills had been forced to close. Saltaire's economic sustainability was probably further enhanced by its 'demographic' sustainability and comparatively high quality of life. These factors would have increased productivity and were thus a worthwhile investment for Titus Salt and subsequent mill owners.

A Marxist-socialist perspective would assess Saltaire's economic sustainability quite differently, based on its capacity to redistribute wealth and deliver economic justice to its population of workers. Saltaire was founded by (and sourced its civic identity from) a profit-driven industrialist, therefore at face value it would be judged very negatively. Since Titus Salt created his profit by converting natural capital to produced capital (textiles), the negative Marxist judgement would in this case coincide with the 'strong sustainability' perspective. However, such criticisms may be partially mitigated by Titus Salt's practical acts of profit redistribution: his notable investment in the housing, welfare and education of his workers.

In light of today's uncertain economic conditions and the complex geopolitical situation in the broader Middle Eastern region, it is difficult to predict Masdar City's economic sustainability with any level of certainty. However, some risks and enhancing factors to capitalist-defined economic sustainability can at least be identified. On one hand, the city's definite focus on a single industry (green energy and technology) may leave it vulnerable to the sudden fluctuations that may occur within this industry, for example as

a result of new global carbon agreements. In addition, the recent debt problems of the *Dubai World* property and investment group may threaten confidence in further 'mega-project' developments such as Masdar City (Elliott 2009). On the other hand, Masdar City's long-term economic prospects should be improved by its hosting of the International Renewable Energy Agency (IRENA) and its investment in elite educational facilities such as the Massachusetts Institute of Technology-partnered Masdar Institute of Technology (Masdar City 2009). If an eco-city project were to be pursued in an Australian location such as the Hunter Valley, these examples should be heeded. It would be important to establish similar institutional connections and take care not to over-specialise.

From a Marxist-socialist perspective, the business-focused Masdar City would face many of the same criticisms as Saltaire, which might similarly be mitigated by the city's major investments in education, public transport and communal open space. However, a Marxist test of economic sustainability arguably has very little practical relevance to Masdar City, given the strongly capitalist context of present day Abu Dhabi and Dubai.

Conclusion

As model city developments of the past and present, Saltaire and Masdar City exist at the forefront of urban planning and innovation. Despite their different contexts, there are significant issues of ecological, social and economic sustainability that are common to both cities, from which interesting concepts and applications can be derived for use in the Australian context. Interestingly, the ultimate conclusions as to the two cities' sustainability vary greatly according to the methods of analysis used and the contextual and ideological values inherent in these methods. Thus, probably the most valuable outcome of this investigation is an appreciation that the concept of sustainability is complex, multifaceted and able to be interpreted in a multitude of ways according to the context and purpose of a project.

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