



IMPACT OF SUSTAINABLE DEVELOPMENT ON QUALITY OF LIFE IN SMART CITIES: A CAUSAL APPROACH

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ABSTRACT

Sustainable development is possible only through fundamental solutions rather than symptomatic solutions. Human beings have now learnt that short term solutions only complicate the systems in the long run. This paper is an attempt to highlight the relationship between social sustainability, economic sustainability, and environmental sustainability and study its influence on quality of life in the back ground of development of smart cities. Using system dynamics methodology, a causal loop was developed from the factors available in the literature and an attempt was made to model and present the system within a working boundary set by the researchers. The model can provide valuable insights to the policy makers by emphasising on the major issues that need to be addressed

Keywords: Smart city dynamics, solid waste management, sustainability, quality of life.

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1. INTRODUCTION

Sustainability is a pressing issue facing the mankind and it is necessary to deal with it tactfully. With scant resources everywhere and the ever growing population not helping in the conservation of resources, it is a crucial phase that the mankind is going through. Solid waste management, economic sustainability, environmental sustainability, social sustainability, sustainable development etc. are some issues that need immediate attention for coming up with long term solutions. This paper attempts to relate these parameters with quality of life and study the smart city from a holistic perspective.

2. LITERATURE REVIEW

The World Commission on Environment and Development (1987), defined Sustainable development as “development that meets the needs of current generations without compromising the needs or ability of future generations to meet their own needs”. According to Hjorth and Bagheri (2006), sustainable development is not a onetime affair rather it is a continuous affair that needs constant monitoring and investment.

Sustainable development is related with peoples’ quality of life in more than one ways (Barkur et al., 2019). Barkur et al. (2019) in their work on smart city dynamics studied the effect of various factors on smart cities development. They used system dynamics methodology and developed a causal loop diagram which acts as a base for our research. We extent the model by Barkur et al. (2019) by thinking from the perspective of quality of life and sustainability. Specifically economic sustainability, social sustainability and environmental sustainability is studied here. Also the effect of solid waste management on the sustainability as a whole is studied here. The basic motto of the sustainable development strategy is to identify and develop actions that can enable to achieve continuous improvement of quality of life of the current generation and also for the future generations (European Council, 2006). This paper makes an attempt to study the sustainability issues in a holistic perspective.

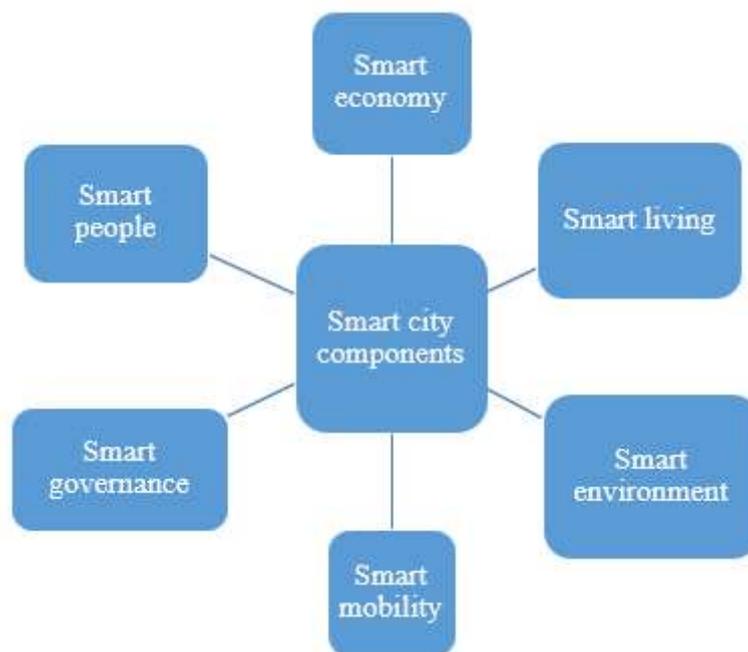


Figure 1 Components of a smart city. (Source: Lombardi et al., 2012)

Figure 1 talks about the components of a smart city that can be considered in any study dealing with smart city dynamics. Lombardi et al. (2012) highlights six factors that can be considered: smart economy, smart living, smart environment, smart mobility, smart governance, and smart people.

The linkage between the society and the ecological system and its interaction with the external environment is shown in figure 2. Gallopin (2003) studied the link between the society and the ecological system. This is an important parameter when we look in to sustainability as a whole.

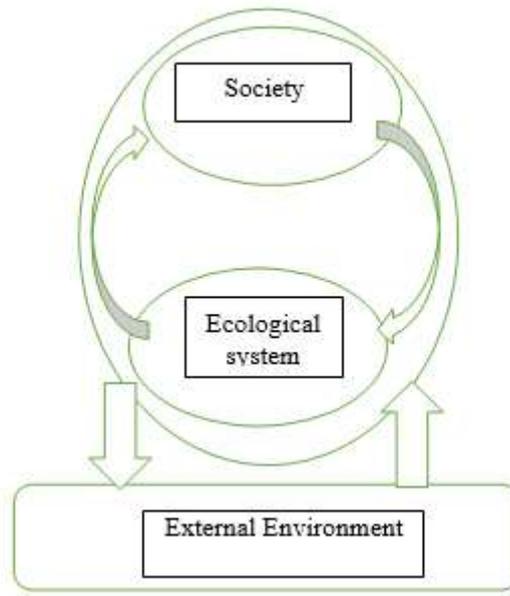


Figure 2 Relationship between society and ecological system (Source: Gallopin, 2003)

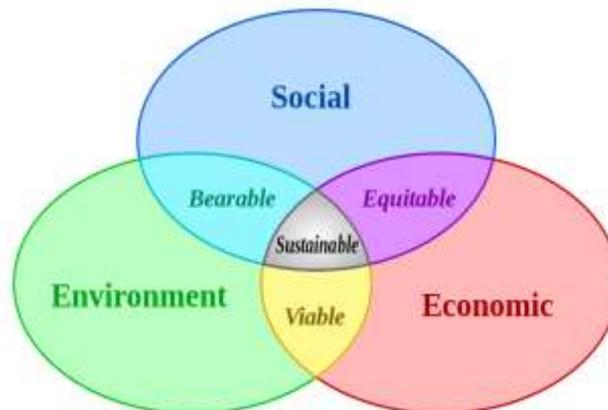


Figure 3 A Sustainable Development Framework

The most common and accepted model of sustainable development framework is shown in figure 3. Social, economic and environmental sustainability is the need of the future and a balance between these three can impact quality of life of the people in the smart cities. Hence, during the development of smart cities, the sustainable development framework is a very helpful and dependable framework.

3. MODEL DEVELOPMENT

Using System Dynamics methodology (Sterman, 2000), an attempt was made to develop a comprehensive model pertaining to the waste management, sustainability and quality of life in smart cities. The model developed can be simulated in the next step with relevant secondary data available based on the mathematical connections between the parameters as adjudged by the researchers keeping a certain logic and theory in the backdrop (Kamath et al., 2013; Vibha et al., 2018).

To develop the causal loop diagram as shown in Figure 11, at every step an attempt was made to relate the relevant parameters based on the available literature. The base model for this study is taken from Barkur et al. (2019).

Figure 4 shows the relationship established for this study between economic, social, environmental and solid waste management issues with the dependent variable sustainability.

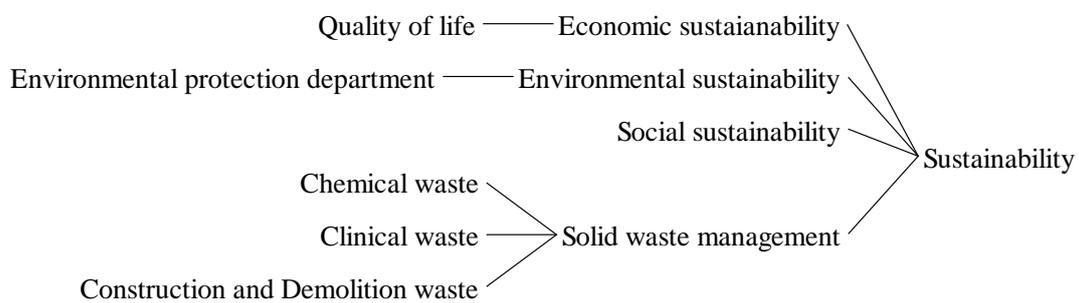


Figure 4 Factors affecting sustainability

Figure 5 depicts the factors that impact the solid waste management. Basically, the effect of chemical waste, clinical waste and construction and demolition waste on solid waste management is depicted here.

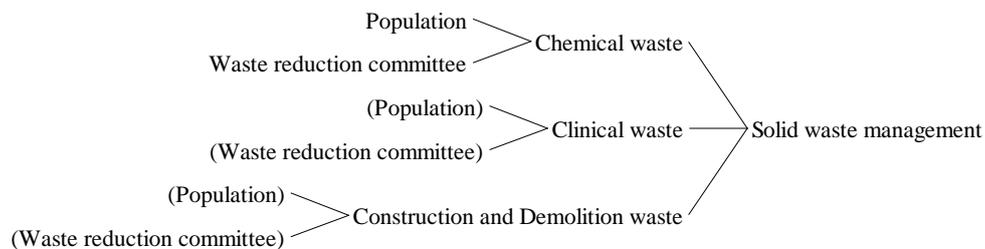


Figure 5 Factors affecting solid waste management

Figure 6 talks about the factors that affect quality of life which in turn influences the economic sustainability.

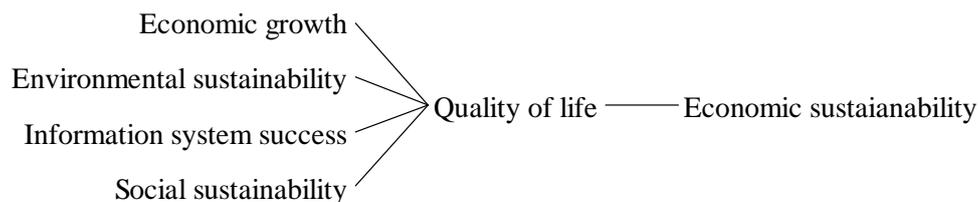


Figure 6 Relationship between quality of life and economic sustainability

Figure 7 highlights the link between quality of life and population keeping in mind the birth rates and the death rates. Varying birth rates and death rates can influence the population growth which in turn affects the resource consumption and it influences the quality of life.

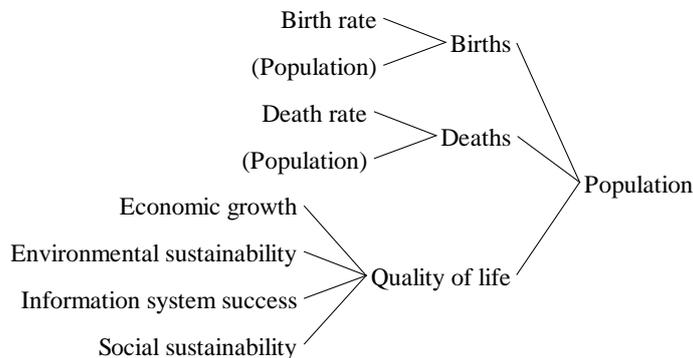


Figure 7 Relationship between the birth rate, death rate, and population

Figure 8 elaborates the linkage between population, investments, information management and quality of life.



Figure 8 Factors leading to investments in smart cities

Figure 9 relates quality of life with the sustainability and other investment and information management in smart cities.

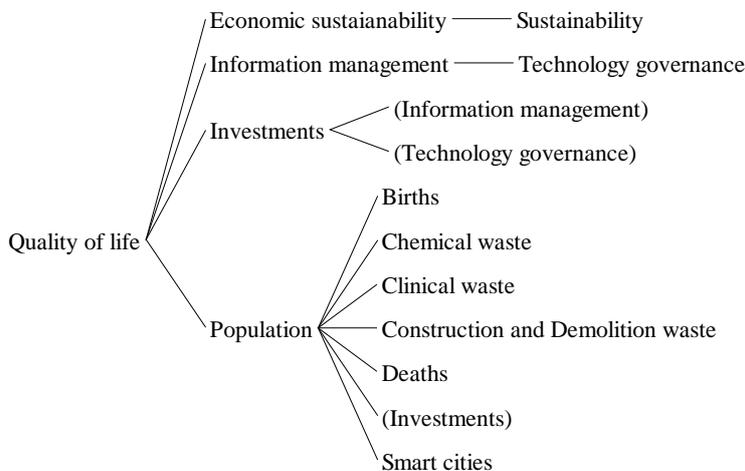


Figure 9 Quality of life and growth

Figure 10 shows the causal loop diagram developed for this study based on the earlier available model by Barkur et al. (2019).

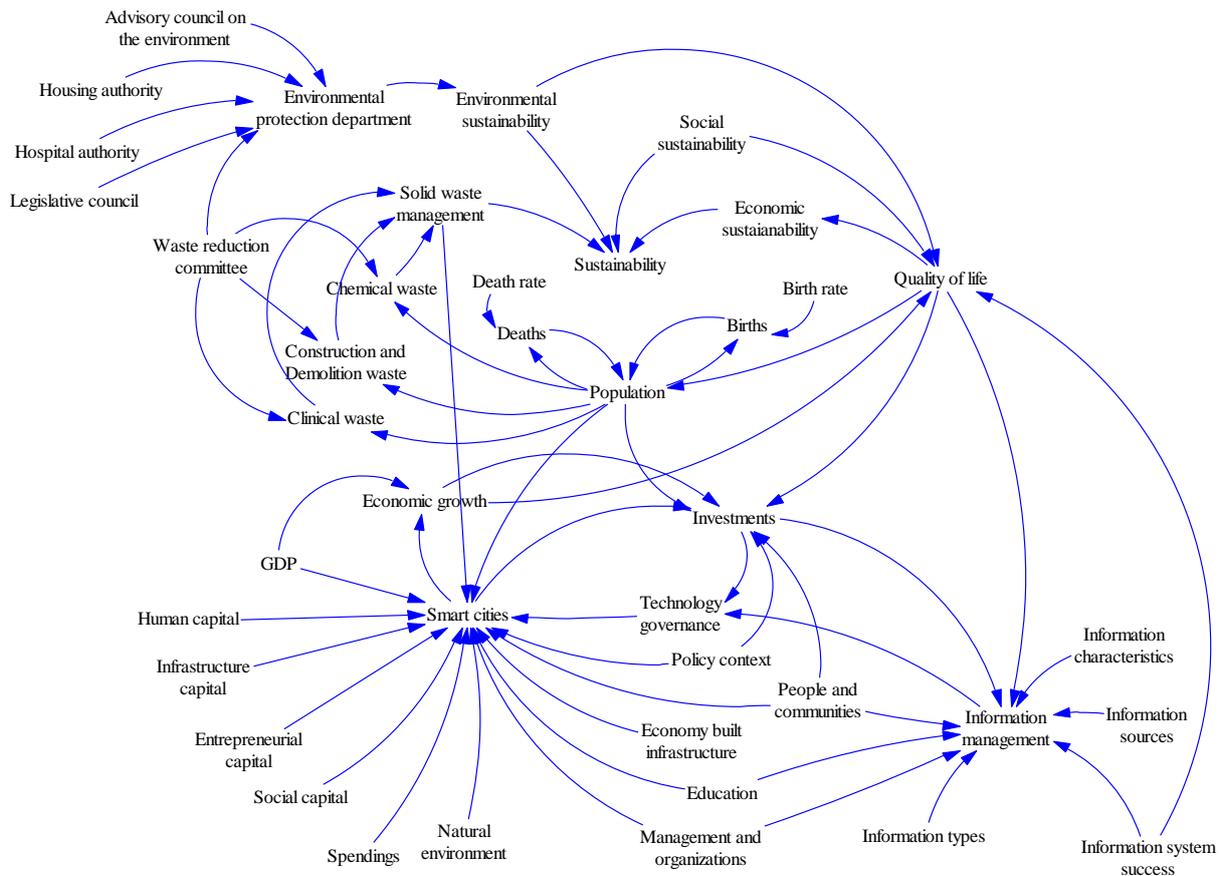


Figure 10 Causal loop diagram (Extended model of Barkur et al., 2019)

As shown in figure 10, sustainability and quality of life must be given equal importance and investments in smart cities must be made wisely and logically to reap the rich benefits like improved quality of life and effective solid waste management.

4. CONCLUSION

This paper extended the model developed by Barkur et al. (2019) by adding certain new perspectives like sustainability and solid waste management. It is quite certain that smart city concepts are here to stay and thus it is vital for the city corporations and the policy makers to ensure that the right moves are taken at the right time to minimise negative impacts if at all. Thus, the simulation models developed can help the policy makers to analyse the situations well in advance and make strategic moves that can speed up the implementations and bring outstanding results. This research developed a causal loop model with sustainability and quality of life factors. In the next step, using secondary data the variables can be linked and simulated to see how the system behaves under critical conditions.

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