**CHAPTER TWO**

**LITERATURE REVIEW**

Waste management is a pressing global challenge which transition into renewable sources energy. This literature review delves into the academic literature by critically examining the potential of bioenergy as a solution to simultaneously address waste management challenges and produce renewable energy. The focus is on the key findings, complexities and potential solutions present in the existing body of knowledge.

Bioenergy holds significant promise as a sustainable solution to address the dual challenge of waste management and renewable energy generation as the world grapples with the ever-increasing amounts of waste. This offers a holistic approach to managing waste while harnessing its potential for renewable energy production (Hoornweg et al., 2012). It is derived from organic matter that offers a compelling solution to address waste management challenges while reducing reliance on fossil fuels. It aligns with the principles of a circular economy where waste is viewed as a resource rather than a problem (Kamp et al., 2019). With these, waste-related challenges can be addressed by converting organic waste while contributing to the transition away from fossil fuels.

Agricultural residues have been explored as a primary feedstock for bioenergy production. These residues which are often considered as waste can be a valuable resource for sustainable energy generation. Crop and forestry waste are examples of agricultural residues that can be converted into bioenergy (Chen et al., 2017). These residues are abundant and can be managed sustainably. The conversion of such waste not only reduces waste volume but also provides an eco-friendly energy source making the process highly sustainable.

Municipal solid waste (MSW) is another prominent feedstock for bioenergy production. MSW includes various types of waste generated by households, businesses and institutions. A significant portion of MSW is organic waste which can be converted into through processes such as anaerobic digestion or incineration (Hoornweg et al., 2012). It provides a unique opportunity to manage waste and also generates renewable energy from a resource that would otherwise be discarded.

The potential of bioenergy for waste management and renewable energy production is substantial with several challenges and complexities needed to be addressed to ensure its success. Technological challenges are among the primary concerns. The effective conversion of waste into bioenergy relies on various technologies, each with its own set of challenges (Mata-Alvarez et al., 2014). For example, anaerobic digestion systems require precise monitoring and control of environmental conditions to optimize biogas production.

Economic viability is another critical factor that deals with assessing the feasibility of bioenergy projects involved in balancing the initial investment required to establish bioenergy facilities with the potential profitability from energy production (Kamp et al., 2019). The financial aspects of these projects require careful evaluation to ensure their sustainability.

Environmental implications are also a significant consideration. This must be assessed from an environmental perspective which includes evaluating factors such as greenhouse gas emissions and potential land use changes (Chen et al., 2017).

To overcome these challenges and make bioenergy a practical solution for waste management and renewable energy, various strategies and solutions are proposed in the literature. Government support and policy development are crucial. Government policies and incentives play a pivotal role in promoting the adoption of bioenergy for waste management (Mata-Alvarez et al., 2014). Supportive regulations can encourage investments in waste-to-energy projects and create a favorable environment for their development.

Technological advancements are essential for overcoming some challenges associated with bioenergy production. Continued innovation and research in the field can enhance the efficiency and cost-effectiveness of bioenergy production processes. An instance is that of the improvements in anaerobic digestion and gasification technologies which shows promise (Kamp et al., 2019).

Public awareness and participation are also vital. Engaging the public in waste separation and recycling programs can reduce the burden on landfills and increase the availability of organic waste for bioenergy production (Hoornweg et al., 2012). When individuals and communities actively participate in waste management efforts, they contribute to reducing waste and ensuring the success of bioenergy projects.