The concept of ‘Smart Cities’ arises to draw a distinction from terms like ‘Digital Cities’ or ‘Intelligent Cities’ so that it looks at the process of urbanization more holistically by involving the social and environmental aspects as well in order to balance the drive for global competitiveness with sustainable development. In other words, cities in future should be well functioning organisms that are environmentally, socially and economically sustainable. A city has to be created by minimizing its ecological impact, where landscape and built form are balanced and where buildings and infrastructures are safe and resource efficient. In essence, cities and individual buildings can focus on achieving resource conservation by enhancing waste minimization and recycling and improving energy efficiency. In addition, new materials, construction methods and architectural designs can greatly improve the environmental performance of urban buildings. These aspects indeed relate to the effective design, construction and management of the built environment. With today’s technology, the increased use of information technology (IT) is key to enabling cities and individual buildings arrive at a more ‘ideal’ state of sustainability through innovation. The much-needed information and knowledge have to be captured, utilized and managed appropriately to allow companies to exploit them as strategic resources. Innovative tools are available and used by various stakeholders for analyzing data to arrive at better decisions, anticipating problems so as to resolve them proactively and coordinating resources for more effective operations. Overall, smarter cities have to drive sustainable economic growth and prosperity for their citizens. At the end of the day, improving lives is central to implementing a smart city given that the main focus of all objectives is about satisfying the population’s needs and priorities. However, the benefits provided by a smart city can be different in terms of context as each would have its own distinct needs and priorities which are based on what the population needs and values at a certain point in time. Therefore, in order for smart city planning to be effective and purposeful, the systems created have to be flexible to change, scalable to size and customizable to requirement because population needs are constantly evolving through time.
The realization of smart building, infrastructure and city will increasingly become widespread with the rapid advancement of innovative technologies that allow the automatic, intelligent (or context-aware) and virtual manipulation of real-time information in the new era of Big Data. A smart city is where the development of infocomm-based integrated networks, capabilities and solutions for the urban environments through a systems-of-systems approach is one of the keys. As such, the building of intelligent enterprises in the various economic sectors has to take place simultaneously to complement the social and environmental targets of achieving the ‘smart’ status. In the more recent years, strategic and smart applications of information technologies are increasingly becoming important as more innovative organizations have witnessed improving their efficiency, effectiveness and performance through better aligning of their technologies with business goals. Moving up to the societal level, people have benefited from the smart systems as they can pre-empt their needs and help them carry out basic activities. They can also empower people by providing them with the information to learn and do the activities themselves in the most efficient way.

Clearly, the consideration of sustainability is highly important in ensuring that the smart city concept works holistically. It is simply because the cities use more technology and as a result they consume more power and other resources which raises their impact on the environment through an increased carbon footprint and waste generation. However, technology-driven solutions have emerged to counter the effects of any potential damage to the environment as cities are beginning to adopt more efficient management of energy use. Take for instance the application of smart grid technology which comprises an electricity system that incorporates IT to determine the levels of demand for power and adjusts the levels of supply accordingly to only generate as much power the city needs. Such systems can be also integrated with waste collection systems to burn biomass as fuel, which adds to the reduction of the city’s dependency on fossil fuels and re-using some of the waste it produces on a daily basis. Other smart solutions for better waste management include plasma gasification whereby organic materials are more efficiently converted to synthetic gas (as harvested energy), as well as using IT to capture data on harvested energy extracted from various stages of waste’s life cycle and making it readily available to businesses for continuous improvement of the design of materials that are biodegradable or recyclable.

The primary reason for presenting a Handbook of Research on the emerging area of smart innovations in built environments for reducing urban waste and pollution is to bring together relevant concepts and technologies, including their applications, that aim to address mounting issues concerning the need to capture and manage huge volumes of data, information and knowledge at different levels ranging from the individual component and system to an entire building and even
city. The collection of works from academics, researchers, scientists, practitioners, policymakers and other experts will present the latest in concept, technology and application of innovations, including those of smart and knowledge-based systems. The unique feature of the book is the structure or, specifically, the arrangement of the parts and chapters in each part. The flow will allow the reader to appreciate the development of the issues, concepts and applications from the micro scales of building components and systems to macro scales of buildings, infrastructures and cities. The target audience will be graduate students, academics, researchers and scientists, engineers, builders, architects, facility managers and government officials who are concerned with advancing information management through the application of smart innovations to create, manage and redevelop the built environment.

Within the Handbook, there are four distinct sections and a total of 11 chapters. Section 1 covers smart city solutions on the micro-scale of building components and systems. In chapter 1, it presents a study that examined the reuse of agro-industrial by-products and concluded that it is a feasible solution for smart city development owing to the ever increasing demand for conventional construction materials, as well as an increase in agro-industrial by-products, which necessitates the reuse of those materials. The focus of section 2 is on innovative solutions for smart buildings as a whole. Chapter 2 details an experiment of passive designs of residential buildings located in 16 cities in the severe cold regions of Northeast China and the results has shown the independent and integrated effectiveness of nine kinds of passive design strategy. In chapter 3, a study of the factors affecting the possibility of introducing smart homes, in developing countries like Nigeria, that would conserve electricity, reduce a need for reliance on the national grid and lower energy costs has provided a better understanding of the advantages and disadvantages, as well as the impact on society and development in general. Moving on to section 3, it offers smart solutions for creating and operating a city’s infrastructures for the provision of public transportation, as well as all the basic utilities and amenities. Chapter 4 deals with the efficiency improvements in the transportation sector, with the aim of reducing pollution from engine fuel emissions, and concluded that it would necessitate behavior and urban planning changes as well rather than financial input alone. In chapter 5, a study of how smart transportation system can be adopted in Harare, the capital city of Zimbabwe, has found that besides the need to design and implement air pollution control measures in the urban areas, the integration of transportation, land use and decision making is also critical in the achievement of smart transport. The last section covers innovative concepts and solutions developed on the macro-scale of cities and communities. Chapters 6, 7 and 8 present possible urban smart solutions to help reduce noise pollution, as well as minimize waste generation. In one study, accounting for noise pollution by incorporating appropriate mathematical optimization models for designing the layout of facilities during the planning
stages of smart cities was found to be effective. The issue of managing and treating construction waste and organic fraction of municipal solid waste (OFMSW) in urban areas has been examined in another study, which included a case-study analysis of the related Dutch, German and Polish guidelines for the sustainable siting of waste processing infrastructure within an urban unit. Concerning urban medical waste, a study has introduced a statistical learning method to estimate the rate of medical waste generation to allow for a more effective way of storing, transporting and disposing the waste. The topic of building smart resilience in cities is next. In chapter 9, the proposed study aims to document the potential and need of developing smart cities in India, as well as understand smart city principles and various dimensions of smart city adopted in various parts of the world which will further help in deriving recommendations and lessons for India’s future smart cities. In chapter 10, the building of smart resilience in cities that allows various stakeholders of urban infrastructures, including the local community, to adapt to changes and uncertainties, via a facility information platform for managing the needs of different user groups, was explained through a new concept of building resilience information modeling. Finally, chapter 11 presents an investigation of the role of total quality management (TQM) in smart city development which culminated in the design of an integrative framework with building information modeling and TQM serving as the information architecture and the ideological premise, respectively.

The scope of the Handbook is broad. The proposed solutions for smart cities to reduce the urban waste and pollution consist of ideas, concepts and/or applications from nine countries, namely, Australia, China, Germany, India, Nigeria, Poland, South Africa, USA and Zimbabwe. They also consist of contributions, many in the form of case studies, from both the developing and developed parts of the world and, as such, have brought together some of the more critical issues of smart city development faced by countries at different stages of economic development for a useful comparison if need be. There are aspects of urban planning and land use, building and infrastructure designs, information and knowledge management, construction project management and IT covered in the 11 chapters. It provides a valuable text for students reading urban planning, architecture and civil engineering, and construction IT and project management subjects at both the undergraduate and graduate levels. It also offers useful insights into the complex workings of smart cities for researchers, policy-makers and practitioners who have a special interest in strategic technology-enabled change. In particular, the case studies in the chapters on passive residential building designs, smart transportation systems, construction waste management in urban areas and smart designs of resilient neighborhoods will provide practitioners, educators and students with important examples of real-life considerations and applications, as well as lessons that can be learnt from the problems encountered in some of the implementations.