Technology and Talent Strategies for Sustainable Smart Cities – Digital Futures

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Technology and Talent Strategies for Sustainable Smart Cities: Digital Futures

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Richard Bowen, has worked at some of the largest and fastest growing technology companies and startups, including Amazon, Microsoft, Facebook and Instacart. He now plies his trade at Chime after working at Robomart, a Silicon Valley startup, as Interim Chief Operating Officer and now Board Member. Rich is also an early-stage startup advisor and mentor, investor, board member, research author and visiting Lecturer, with over 15 years of industry diverse operations experience, with a balance of business experience and academia. Rich holds a first class, with honours BA in Business and Management and is a doctoral candidate. Rich was recently nominated to attend Stanford University Executive Education Programme, focused on the Emergence of Chief Operating Officers.

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Rejwan Bin Sulaiman, is a highly accomplished individual who is currently pursuing his PhD degree in Computer Science from the University of Bedfordshire, located in the United Kingdom. Prior to this, he earned an MSc in Computer Science from the same institution in 2019, after completing his BSc from Wrexham Glyndwr University in 2018. In addition to his academic qualifications, he holds several professional certifications, including C|EH, CCNA and AWS, which testify to his deep knowledge and expertise in the field. Rejwan's research interests primarily focus on the cutting-edge fields of Cyber security, Artificial Intelligence and Machine Learning, where he has made significant contributions. His innovative work has been presented in various conferences and journals, and he regularly participates in scientific meetups to share his insights and learn from others in his field. Recently, Rejwan has been working as a Lecturer at Northumbria University. He is also leading a dynamic research group at STEMResearch.ai, where he continues to drive innovation and advance the boundaries of knowledge in his field.

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Preface

Information and communication technology and social media are creating awareness and new stories about the role of technologies in creating sustainable cities, energy-efficient cities, smart cities, smart communities, green rooms and so on. Is there is any real potential, or it is a conflict of interest – 'technology claims that technology is the best solution for you'.

Currently, half of the world's population lives in cities, and this number is going to cross 70% by the year 2050. Rapid urbanisation is creating problems of optimal capacity, energy consumption, social inequality, traffic congestion, water contamination, education and health-related issues, pollution and suitable development (International Telecommunication Union (ITU), 2021).

Governments, communities and planners are considering the use of ICT (Information and Communication Technology), renewable energies and a host of other technologies to build sustainable and smart cities for their citizens. Sustainable smart cities intend to improve the efficiency of operations in the cities, green energy, water supply, sanitation and waste management, inclusive housing, healthcare and education, optimise the flow of air, water, people and traffic, improve quality of life, efficiency policing, innovations and the overall attempt to meet economic, social, environmental and cultural needs of the present as well as that of the future. The use of technologies can accelerate the efficient achievement of UN specified 17 Sustainable Development Goals (SDGs) goals. However, are our cities ready for this as per capacity, needs, sustainability and smartness is concerned?

A sustainable smart city is an innovative city that uses Information and Communication Technologies (ICTs) and other technological means to improve the quality of life, the efficiency of urban operations and services and competitiveness, while also meeting the economic, social, environmental and cultural needs of current and future generations (UNECE and ITU, 2021). A sustainable Smart city is 'more sustainable, efficient, inclusive, pleasant, with better livability, workability inclusiveness, sustainability, responsive and continuously improves the quality of life' (Hamza, 2021) (Woetzel, 2021) (Woetzel, 2021) (Amazon Web Services, 2018).

A smart city has three layers; technology enables Internet of Things (IOTs), smart applications of data analytics for better decision-making and behaviour change to continuously enhance the quality of life (Woetzel, 2021). The quality of life has many dimensions such as safety, time and convenience, health,

environmental quality, social connectedness and civic participation, jobs, and the cost of living and so on.

Are the technologies themselves enough to create real differences in countries, cities and communities as per MDGs and create a healthier planet, or do we need some complementary actions such as the role of awareness and actions of stakeholders, leaders, governments and communities? Do people bother about MDG and the triple bottom line – people, planet and profits? What kind of cities does people need and would love to have in the future? What about the agenda of sustainable and smart cities? How can we inspire actions?

It has been widely argued that the application of the technology will save energy, cloud technologies can save forests, Blockchain can bring ethics and authenticity saving millions from frauds and so on; however, what about the use of energy itself in the running of the technologies?

Audience

This book will aid in the knowledge of policymakers, governments, researchers, entrepreneurs and practitioners, to design, develop and implement technology to create and develop sustainable smart cities. Using many theoretical and practical approaches, this innovative book aims to further explore the use of disruptive technology.

Key Features of the Book

This book will be a unique interdisciplinary project inculcating and integrating ideas of public policies, business and techno-entrepreneurs with those with a stream of technology. This book will be a useful source for academics, researchers, governments, city planners and techno-entrepreneurs to understand and apply the principles and the practices of technology empowered strategies to develop integrated sustainable and smart cities in developed, developing and least-developed countries. This book brings in ideas from east and west in one place and is useful in light of UNOs Millennium Development Goals, in particular of least-developed countries, developing countries and emerging markets. This book has a focus to humanise technological applications in a green and sustainable way for smart cities and futures.

Organisation of This Book

This book has explored the concept, model and practice of conceptualising and developing smart cities. This book is written from a strategic point of view. It has also covered a range of functional areas of smart sustainable cities. An integrated approach is taken to organise this book from top to lower levers of organisations. Though each chapter on its own has independent standing and can be read for its relevance to relevant functional areas, however, an integrated approach has been

taken organising each chapter to ensure smooth flow, coherence and process approach.

This book is organised into 14 chapters. A brief description of the chapter is given in the next sections.

Chapter 1 – *IoT (Internet of Things), Cloud Computing and the Elementary Building Blocks of Smart Sustainable Cities*

As the size of the population is growing and the capacity of the planet earth is limited, human beings are searching for sustainable and technology-enabled solutions to support society, ecology and economy. One of the solutions has been developing smart sustainable cities. Smart sustainable cities are cities as systems, where their infrastructure, different subsystems and different functional domains are virtually connected to the information and communication technologies (ICT) and internet via sensors and devices and the Internet of Things (IoT); to collect and process real-time Big Data and make efficient, effective and sustainable solutions for a democratic and liveable city for its various stakeholders. This chapter explores the concepts and practices of sustainable smart cities across the globe and explores the use of technologies such as IoT, Blockchain technology, Cloud computing, etc. their challenges and then presents a view on business models for sustainable smart cities.

Chapter 2 – *Financing of Sustainable Smart Cities: Indian Experience*

India launched Smart City Mission in 2015 with an objective of development of 100 smart cities with a completion deadline in 2019 that was extended till June 2023. This chapter focuses on financing of sustainable smart cities in India. This chapter summarises financing options explored by the government in the beginning, challenges faced in financing of Smart City Mission in India over a period due to various developments such as pandemic and delay in execution of projects under the Smart City Mission, among others. Finally, suggestions have been given for making financing means effective and sustainable. These suggestions are based on the gaps between the 'financing means thought of' in the beginning and 'financing means actually applied' while executing Smart City Mission in India. Financing part is worth exploring in the background that India had the fiscal deficit at 3.9% of Gross Domestic Product (GDP) in 2015–2016 and most recently, the country had the fiscal deficit at 6.71% of GDP in FY22. And the country also dealt with the pandemic like other economies and provided Covid-19 vaccine free of cost to all citizens. Insights are useful for any other economy with a similar sustainable and Smart City Mission while facing resource constraints.

Chapter 3 – *The Role of Digital Agriculture in Transforming Rural Areas into Smart Villages*

A rural economy can contribute significantly to producing employment, fostering economic growth and fostering sustainable development. The Smart Villages strategy delves into a vast range of policies and there can be no one-size-fits-all approach that can fit the context of each community and cater to their unique circumstances. There is no single route to being smart. From the perspective of any nation, rural areas present a comparable set of problems, such

as a lack of proper health care, education, living conditions, wages and market opportunities. Some nations have created and developed the concept of smart villages during the previous few decades, which effectively addresses these issues. The landscape of traditional agriculture has been radically altered by digital agriculture, which has also had a positive economic impact on farmers and those who live in rural regions by ensuring an increase in agricultural production. We explored current issues in rural areas, and the consequences of smart village applications, and then illustrate our concept of smart village from recent examples of how emerging digital agriculture trends contribute to improving agricultural production in this chapter.

Chapter 4 – *Rural Areas, Smart Villages and Digital Agriculture – Case Study of Coimbatore's SMART Water Management System*

The purpose of this chapter is to develop academic answers to the key rural areas and smart villages and digital agriculture. This chapter analyses the National level initiatives of Government of India Mission to convert rural areas into smart cities. The Union Ministry of urban development collaborates with the State Government and nominates a particular city or cities in their state. Financial Incentives or benefits will be provided to enhance the quality of the city. Coimbatore is a cosmopolitan city where it is also a combination of rural villages and urban township. The main objective of this chapter is to identify and explore the initiatives of SMART CITIES MISSION a joint venture activity initiated by Government of India and State Government of Tamil Nadu. The results clearly indicate how digital technologies play a pivotal role in enhancing the quality of eco-friendly initiatives and improving smart villages and agriculture. The key recommendations are the lessons learnt from other smart cities initiatives in other states and how Coimbatore can be an example and adopt key takeaways from other states and cities around the world.

Chapter 5 – *Role of the Governance and Good Governance to Build a Smart Economic and Smart City – A Case Study of Bangladesh*

This chapter discusses the role of government to ensure good governance and good citizen policy choices that benefit the smart city and economy in Bangladesh. The concept of governance recognises the power dependency that exists between institutions that are engaged in collective action. Government, according to UNESCAP, is a process through which choices are made and executed or rejected. Corporate governance, international governance, national governance and municipal governance are just a few examples of how the term governance may be employed. Governance was also cited by UNESCAP as a player in government. To build a smart city and economy national level of governance focuses on freedom of media, country history and traditions, civil society, private sector and good government. All those elements are important to build a smart economy and smart city.

Chapter 6 – *Towards Sustainable Smart Cities: Current Trends and Development*

This chapter analyses a conceptual model for sustainable smart cities that integrates the three main components – technology, Sustainability and citizen. As

the world continues to urbanise, cities face increasing pressure to become more sustainable, efficient and livable. Sustainable smart cities are emerging as a promising solution to this challenge, leveraging technology and data to improve urban systems and services while reducing environmental impact. This chapter provides an overview of the concept of sustainable smart cities and its implications for urban development. It explores the key features of sustainable smart cities, including their focus on technology, data and citizen engagement, and the challenges they are facing in terms of infrastructure, data management, social equity, environmental sustainability, governance and regulations. This chapter also highlights the implications of sustainable smart cities for urban planners, policymakers and other stakeholders, emphasising the need for collaborative approaches that engage citizens and stakeholders in the design and implementation of smart city initiatives.

Chapter 7 – *Smart City Digital Twins: Overview of Implementation Challenges and Recommendations for Citizens Training*

A Digital Twin (DT) is a digital replica of an artefact that is updated on real time or semi-real time basis. In 2017, Gartner listed DT as one of the top 10 emerging technologies of the year. Since then, there have been numerous attempts to develop architecture and reference models for DTs (Digital Twin), and in some studies DT construction for real world case studies is reported. Digital Twin has evolved to a dynamic model, especially in the design of systems and products. It comes into existence digitally during the creation phase, takes a physical form in the manufacturing phase, continues through its operational life and is eventually disposed of as explained by Grieves and Vickers. This chapter attempts to provide a contextualised background on Digital Twins for Smart Cities. In the first phase of creating the physical twin, the designed and developed physical system is embedded with the digital twin and any changes experienced in the physical twin throughout the lifetime of the lifecycle of the product or the system impact the digital twin. In the next phase of the system or product development, the predictions of its behaviour during the creation phase are tested out in the operation phase. If done correctly then all the Unpredicted Undesirable (UU) and Unpredicted Desirable (UD) would result in a low chance of significant challenges occurring in the system. The culminating process, also known as the disposal stage, focuses on the impact the system has on its surroundings once decommissioned. This chapter also discusses various stakeholders involved in devising and/or employing DTs in a Smart City. This chapter concludes with a set of recommendations for the training requirements of final DT users.

Chapter 8 – *Decision-Making in Smart Cities – Blockchain Technology*

Successful smart cities' implementation will require organisational leadership decision-making competences. The foundation of smart cities is digital technologies; many of these technologies are emerging technologies that require IT skills, which are scarce and will exacerbate the battle for talent between organisations. Filling the talent gap will necessitate global hiring, which has implications for organisational culture, cultural diversity and organisational leadership. Organisational cultural mix is an important contributor to leadership decision-making.

However, decision-making is underpinned by trust. Blockchain is an emerging technology that has the potential to engender organisational trust in decision-making and, by extension, in the leadership with the 'right' organisational culture. Smart cities will be required to leverage emerging technologies to give business performance a competitive advantage and use emerging technologies applications to build a sustainable competitive advantage.

Chapter 9 – *Investigating the Influence of Blockchain in Building Trust Network – Smart Transport Networks in a Smart City*

This chapter aims to investigate and identify blockchain-related innovation trends that can improve trust networks in Smart city's transport and supply chain networks. Trust networks are crucial in building and maintaining the trust of citizens in smart cities. By promoting transparency and accountability, facilitating collaboration and innovation, enhancing citizen participation and protecting privacy and security, trust networks can help to ensure that smart cities are developed and implemented responsibly and sustainably. A systematic literature review identifies 60 conceptual and empirical studies while focusing on the automotive sector. This research focuses on the current problems and developing procurement and supply chain strategies, and the potential benefits of using blockchain in these areas. It suggests ways for the Smart city's transport and supply chain networks to utilise the blockchain to improve operations and supply chain strategy and identifies innovation trends related to blockchain. This study also includes a systematic literature review and Blockchain Transformation and Influence model as a basis to enhance trust networks in the Smart Transport Networks in a Smart City.

Chapter 10 – *Microgrid TestBed for Temporal Forecasting Patterns of Failure for Smart Cities*

The malfunction variables of power stations are related to the areas of weather, physical structure, control and load behaviour. This chapter explores the most useful factors that affect the accuracy of the Smart Grid short-term prediction process. Predicting temporal power failure is difficult due to its unpredictable characteristics. As a high accuracy is normally required, the estimation of failures of short-term temporal prediction is highly difficult. This study presents a method for converting stochastic behaviour into a stable pattern, which can subsequently be used in a short-term estimator. For this conversion, K-means clustering is employed, followed by Long-Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) algorithms are used to perform the Short-term estimation. The environment, the operation and the generated signal factors are all simulated using mathematical models. Weather parameters and load samples have been collected as part of a dataset. Monte-Carlo simulation using MATLAB programing has been used to conduct an experimental estimation of failures. The estimated failures of the experiment are then compared with the actual system temporal failures and found to be in good match. Therefore, for any future power grid there is a ready testbed to estimate the future failures.

Chapter 11 – *CNN (Convolution Neural Network) Based Intelligent Streetlight Management Using Smart CCTV Camera and Semantic Segmentation*

One of the most neglected sources of energy loss is streetlights that generate too much light in areas where it is not required. Energy waste has enormous economic and environmental effects. In addition, due to the conventional manual nature of operation, streetlights are frequently seen being turned 'ON' during the day and 'Off' in the evening, which is regrettable even in the twenty-first century. These issues require automated streetlight control in order to be resolved. This study aims to develop a novel streetlight controlling method by combining a smart transport monitoring system powered by computer vision technology with a closed circuit television (CCTV) camera that allows the light-emitting diode (LED) streetlight to automatically light up with the appropriate brightness by detecting the presence of pedestrians or vehicles and dimming the streetlight in their absence using semantic image segmentation from the CCTV video streaming. Consequently, our model distinguishes daylight and nighttime, which made it feasible to automate the process of turning the streetlight 'ON' and 'OFF' to save energy consumption costs. According to the aforementioned approach, geolocation sensor data could be utilised to make more informed streetlight management decisions. To complete the tasks, we consider training the U-net model with ResNet-34 as its backbone. Validity of the models is guaranteed with the use of assessment matrices. The suggested concept is straightforward, economical, energy-efficient, long-lasting and more resilient than conventional alternatives.

Chapter 12 – *Security Challenges of Digital Transformation in Smart Cities: Case of Banking Sector*

Banking traces back to 2000 BC in Assyria, India and Sumeria. Merchants used to give grain loans to farmers and traders to carry goods between cities. In ancient Greece and Roman Empire, lenders in temples provided loans and accepted deposits while performed change of money. The archaeological evidence uncovered in India and China corroborates this. The major development in Banking came predominantly in the mediaeval, Renaissance Italy, with the major cities Florence, Venice, and Genoa being the financial centres. Technology has become an inherent and integral part of our lives. We are generating huge amount of data in transfer, storage and usage, with greater demands of ubiquitous accessibility, inducing an enormous impact on industry and society. With the emergence of smarter cities and societies, the security challenges pertinent to data become a greater, impending impact on consumer protection and security. The aim of this chapter is to highlight if, SSI (Self Sovereign Identity) and Passwordless authentication using FIDO-2 protocol assuages security concerns such as authentication and authorisation, while preserving the individual's privacy.

Chapter 13 – *Data Analytics on Key Indicators for the Smart City's Urban Services and Dashboards for Leadership and Decision-Making by Machine Learning*

This chapter culminates in data analytics on key indicators for the city's urban services and dashboards for leadership and decision-making. A single web page with consolidated information, real-time data streams pertinent to planners and decision-makers as well as residents' everyday lives, and site analytics as a method

to assess user interactions and preferences are among the proposals for urban dashboards. Integrating technology and data analytics is revolutionising how cities manage their urban services. This chapter explores the use of data analytics to evaluate key performance indicators for smart cities, and the potential benefits of using dashboards for leadership and decision-making. The results of the analysis provide valuable insights into the strengths and weaknesses of these services and can be used to guide decision-making processes. In addition to data analytics, this chapter also examines the use of interactive dashboards to visualise and communicate the results of these performance indicators to decision-makers. Dashboards can provide real-time data, allowing leaders to quickly understand the current state of their urban services and make informed decisions to enhance these services. The results of this study demonstrate the potential for data analytics and dashboards to significantly improve the management of urban services in smart cities. By utilising these cutting-edge tools, cities can increase their efficiency, provide better services to their citizens and promote sustainable and habitable communities.

Chapter 14 – *The Role of Psychometric Test and Behavioural Profiling in Civil Service Exams in Developing Countries for Smart Societies*

The changing environment and competitive market forces have brought many changes in the business sector that has put organisations under immense pressure. Therefore, to gain a competitive advantage various transformations and new developments are found in the area of recruitment and selection to make precise decisions. Therefore, the use of psychometric assessments and behavioural profiling has increased significantly worldwide as organisations of all sizes and natures have found these assessment tools valid and effective. Although behavioural profiling and psychometric assessments are accepted worldwide, however, developing countries particularly the public sector still relies on conventional recruitment methods and the adaptation of contemporary behavioural profiling and psychometric assessments is a challenge. Therefore, this chapter evaluates how the adaptation of behavioural profiling and psychometric assessments in the civil service exams in developing countries can improve the selection process. It also explores the potential challenges and argues how the adaptation of behavioural profiling and psychometric assessments can help to improve the quality of public services, capacity building and achieving sustainability goals.

Conclusion

This book will be a unique interdisciplinary project inculcating and integrating ideas of public policies, business and techno-entrepreneurs with those with a stream of technology. This book will have inputs from fields of technologies, ICT, IoT (Internet of Things), big data analytics, blockchain, robotics, business, city planning, sociology of communities, sustainable development and an integrated approach to sustainable smart city futures.

Feedback

The editor and the authors look forward to readers' constructive feedback. Please let us know your view of this book and suggested areas of improvement by emailing the editors.

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