A conceptual multi-criteria pattern of sustainable urban development in sprawled cities: Case study Berlin as a sprawling city in Germany

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Case study Berlin as a sprawling city in Germany

BAUHAUS UNIVERSITÄTSVERLAG Band 29 der Schriftenreihe Bau-und Immobilienmanagement, herausgegeben von Bernd Nentwig

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Foreword

Ecological Criteria can be seen as a main driver for re ection urban developments, in this case Berlin as a sprawling city in Germany.

In this work the author touches all relevant ecological indicators with statistical methods, which leads to a cumulative gain of knowledge.

Reza Sheikhbakloo's publication o ers a comprehensive, strategic approach dealing with statistical data in ecological orientated urban development.

Weimar, December 2017

Prof. Dr.-Ing. Bernd Nentwig

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Abbreviations

Abbreviations

BBR:	Bundesamt für Bauwesen und Raumordnung (Federal Office for Building and Regional Planning)
BBSR	Federal Institute for Research on Building, Urban Affairs and Spatial
DDOIG	Development
BMBF:	Federal Ministry of Education and Research
BMVBS:	Federal Ministry of Transport, Building and Urban Development
BMZ:	German Federal Ministry for Economic Cooperation and Development
BUND:	Bund für Umwelt und Naturschutz Deutschland
BUUF:	Baltic University Urban Forum
CLTM:	Commissie Lange Termijn Milieu-Beleid
COPs for	climate change: Conference of the Parties for climate change
CSD:	Commission on Sustainable Development
DED:	German Development Service
DSD:	Division of Sustainable Development
EAPs:	Environmental Action Programs
ECI:	European Commission Indicators
EEA:	European Environment Agency
EIA:	Environmental Impacts Assessment
ESD:	Education for Sustainable Development
EU-SILC:	The EU Statistics on Income and Living Conditions
GDP:	Gross Domestic Product
GHG:	Green House Gases
GIS:	Geographical Information System
GIZ:	Deutsche Gesellschaft für Internationale Zusammenarbeit
GNP:	Gross National Product
GTZ:	Gesellschaft für Technische Zusammenarbeit
HSE:	Health, Safety and Environment
HTW:	Hochschule für Technik and Wirtschaft
TET 4	

- IFLA: International Federation of Library Associations and Institutions
- ILO: International Labor Organization
- ISS: International Space Station
- IAEA: International Atomic Energy Agency
- ICLEI: International Council for Local Environmental Initiatives
- IISD: International Institute for Sustainable Development

JIE:	Journal of Industrial Ecology
JUMP:	program to reduce youth unemployment
LA-21:	Local Agenda 21
LCA:	Life Cycle Assessment
LCAI:	Life Cycle Assessment Indicators
LCCI:	Life Cycle Cost Indicators
ICT:	Information and Communication Technologies
LDCs:	Least Developed Countries
LFS:	The Labor Force Survey
LIKI:	Land Initiative Kernindikatoren
MRSC:	Municipal Research and Services Center
NABU:	Der Naturschutzbund
NCSE:	National Council for Science and the Environment
PUD:	Perceived Urban Density
R & D:	research and development
REC:	Regional Environmental Center for Central and Eastern Europe
SARD:	Sustainable Agriculture and Rural Development
SDG:	Sustainable Development Goals
SDGs:	Sustainable Development Goals
SDI:	Sustainable Development Index
SDS:	Sustainable Development Strategy
SPSS:	Statistical Package for the Social Sciences
SUD:	Sustainable Urban Development
TISSUE:	Trends and indicators for monitoring the EU Thematic Strategy on
	Sustainable Development of Urban Environment
TSA:	Tourism Satellite Account
TSD:	Time-Space Density
UDD:	Urban Demographic Density
UDIA:	Urban Development Institute of Australia
UHC:	Universal Health Coverage
ULD:	Urban Land-use Density
UMD:	Urban Mass Density
UNCED:	UN Conference on Environment and Development
UNCSD:	The United Nations Commission on Sustainable Development

Abbreviations

The United Nations Environment Program/Global Resource
Information Database
The United Nations Educational, Scientific and Cultural Organization
The United Nations Framework Convention on Climate Change
The United Nations High Commissioner for Refugees
The United Nations Office on Drugs and Crime
United Nations World Summit on Sustainable Development
Urban Resource Density
Urban Sustainability Index
World Commission on Environment and Development
World Health Organization
World Trade Organization

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Introduction

1.1 Research background

"Sustainable development" perception was considerably extended after 1987. it has been developed by a global political process that has attempted to integrate existing global concerns includes; the requirement for economic development to fight social and personal poverty in first, the requirement for environmental preservation and protection secondly and finally the requirement for "social justice and cultural diversity" to enhance standards of the local communities in solving these problems. The main elements of sustainable development are "economic development, environmental protection, and social equity" as the concept of three mutually fortifying pillars of sustainable development (WCED, 1987).¹

According to United Nations (2014)², Department of Economic and Social Affairs, Population Division, nowadays more than 50 percent of the population on the earth living in cities and it is expected to meet this rate to 66 percent by 2025. Forecasts display that urbanization merged with the global growth of the world's population could increase billions of people to urban populations by 2050 and addressing the issue of urban development with a sustainability approach goes to be a basic principle in development. Sustainability and using of indicators of sustainable development are the significant criteria that decision makers and designers have focused on them in urban development during the past decades until now. It is important to define some indicators of sustainable development that by applying them we will enable to monitor and evaluate policies, aims, goals, objectives, plans and programs. Prioritizing objectives and programs, allocating resources like human and financial, interaction between interested parties and measuring performance are the key areas, which will be quantified by indicators of sustainable development (OECD, 1997).³

One of the most outstanding characteristics of sustainable development is the addressing sustainability indicators and its role in achieving effective and practical results in the field of sustainable development, which were specifically introduced at the conference of Earth in 1992. In addition, improving and growing trend of these indicators of sustainable development has

¹ World Commission on Environment and Development (WCED), (1987) Our common future. New York: Oxford University Press.

² United Nations (2014) Department of Economic and Social Affairs, Population Division, World Urbanization Prospects: The 2014 Revision

³ Organization for Economic Cooperation and Development (OECD), (1997) Better understanding our cities: The role of urban indicators, Paris

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been emphasized at the international, national, and local levels. International associations such as the United Nations (2001)⁴, OECD (2000)⁵ and WCED (1987)⁶ acted a significant duty in developing indicators that assess development at the national level.

Paek (2006)⁷ argued that at the local level, numerous towns engage initiatives in developing sustainability indicators as part of actions to fulfill urban sustainability especially as a sprawled city. For instance, "the Sustainable Seattle Indicators Project (Sustainable Seattle, 1998)⁸, the Central Texas Sustainability Indictors Project (Central Texas Sustainability Indictors Project, 2004)⁹; the Santa Monica Sustainable City Plan (City of Santa Monica, 2005)¹⁰; the Portland Sustainability Initiative (City of Portland, 2000)¹¹; the San Francisco Sustainability Plan (Sustainable City, 1996)".¹²

Therefore, data gathering and policy makers and designers should lead data mining process properly plays a highlighted for accessing to sustainable development criteria.

The drivers of urban sprawl

To find a suitable solution for urban sprawl challenges, it is essential to understand the forces driving urban sprawl within sustainable urban planning strategies. According to the current research information in the sprawling cities development, the main reason of sprawling and expanding of cities is residential expansion along with wide range of development in economic projects and enhancing transportation systems. Particularly when we are going to the European urban studies, it is essentially a significance result of growing population and public and private transport demand in European countries and cities and somewhat

⁴ United Nations (2001) Indicators of sustainable development: Guidelines and methodologies New York: United Nations, Division for Sustainable Development

⁵ Organization for Economic Cooperation and Development (OECD), (2000) Towards sustainable development: Indicators to measure progress. Proceedings of the OECD Rome Conference, Paris: OECD

⁶ World Commission on Environment and Development (WCED), (1987) Our common future. New York: Oxford University Press.

⁷ Paek, S. (2006) Urban Growth Pattern and Sustainable Development, Texas A&M University

⁸ Sustainable Seattle (1998) Indicators of sustainable community, Seattle: Sustainable Seattle.

⁹ Central Texas Sustainability Indicators Project (2004) The central Texas sustainability indicators project: Annual report 2004. Austin, TX: Central Texas Sustainability Indicators Project

¹⁰ City of Santa Monica (2005) Sustainable city plan

¹¹ City of Portland (2000) Sustainability benchmarks: Portland & selected U.S. cities

¹² Sustainable City (1996) The sustainability plan for the City of San Francisco. [online] Available from: http:// www.sustainable-city.org

high growths in the worth of developed areas (EEA, 2006)¹³. The desirability of dwelling in the downtown of cities has decreased; on the other hand the quality of life in 'rural areas' containing city borders, near to natural environment, has expanded. These features show planning issues for small municipality's effort to sustain their residents and support small and medium-sized businesses (Barredo et al., 2003).¹⁴ According to the European Environment Agency EEA (2006), the key drivers of urban sprawl are categorized in the Table 1.1.



	Main categories	Sub-categories
1	Macro-economic aspects	 Economic progress Globalization European countries union
2	Micro-economic aspects	 Increasing living values Worth of terrestrial places Accessibility of low-priced natural environment Competition between cities
3	Demographic aspects	 Increasing Inhabitants Rising in household establishment
4	Housing favorites	 More land per each human Housing favorites
5	Inner city issues	 Decreasing air quality Noise pollution Small apartments Hazardous environments Social issues Lack of green belts and parks
6	Transportation networks	 Private car ownership Accessibility of streets and highways Low cost of fuel Improper public transport
7	Governing contexts	 Weak land practice planning Improper implementation of current plans Shortage of horizontal and vertical coordination and collaboration

¹³ European Environment Agency (EEA), (2006) Urban sprawl in Europe, The ignored challenge, ISSN 1725-9177

¹⁴ Barredo, J. I., Kasanko, M., McCormick, N., and Lavalle, C. (2003) Modeling dynamic spatial processes: simulation of urban future scenarios through cellular automata Landscape and Urban Planning, 64(3), 145–160

¹⁵ European Environment Agency (EEA), (2006) Urban sprawl in Europe, The ignored challenge, ISSN 1725-9177

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The future development patterns could be estimated in based on the existing trend of past decades' statistics data. The estimated inhabitant's growth in European urban areas at the past decades is equivalent with the growth of population in the future. "Therefore, the land use scenario for the year 2020 follows the main trends from 1988 to 2000 with slightly smaller growth expectations by using the MOLAND model" (Barredo et al., 2003).¹⁶

On the other hand, a number of research literature sources about the former socialist countries of central and Eastern Europe presents groups of compact cities form and high densities in this area principally expose the supportive centralized planning systems and extensive dependence on public transport. According to the Ott (2001)¹⁷, Nuissl and Rink (2005)¹⁸ as cited in EEA (2006)¹⁹; nowadays, these European cities like Berlin in Germany are encountering the same risks of fast urban sprawl as "the land market is liberated, housing preferences evolve, improving economic prospects create new pressures for low density urban expansion, and less restrictive planning controls prevail".

Existing sustainability indicator systems

According to the existing literature review, so many sustainability indicator systems worldwide measure SD or sustainability. Figure 1.1 illustrates models with different levels (e.g. national, regional, city & building level) that focus on different aspects of sustainability. In general, there is a wide range of sustainability definitions and obviously, it is an essential method to realize the valuable concepts that each organization defines it. "The most commonly cited interpretation, has been noted by 13 of the groups is that of the Brundtland Commission, which emphasizes intergenerational equity" (WCED, 1987).²⁰ (Figure 1.2)

¹⁶ Barredo, J. I., Kasanko, M., McCormick, N., and Lavalle, C. (2003) Modeling dynamic spatial processes: simulation of urban future scenarios through cellular automata Landscape and Urban Planning, 64(3), 145–160

¹⁷ Ott, T. (2001) From concentration to de-concentration and migration patterns in the post-socialist city. Cities, 18(6), 403–412.

¹⁸ Nuissl, H. and Rink, D. (2005) The 'production' of urban sprawl in eastern Germany as a phenomenon of post-socialist transformation. Cities, 22(2), 123–134.

¹⁹ European Environment Agency (EEA), (2006) Urban sprawl in Europe, The ignored challenge, ISSN 1725-9177

²⁰ World Commission on Environment and Development (WCED), (1987) Our common future. New York: Oxford University Press.

Figure 1-1 Facets of Sustainability Supported by 19 Sustainability Indicator Systems (Lynch et al., 2011)²¹



In 1987, the Brundtland Commission of the United Nations presented the comprehensive approach of sustainable development: "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987).²²

²¹ Lynch A. J., Andreason S., Eisenman T., Robinson J., Steif K. and Birch E. L. (2011) Sustainable urban development indicators for the United States, Report to the Office of International and Philanthropic Innovation, Office of Policy Development and Research, U.S. Department of Housing and Urban Development.

²² World Commission on Environment and Development (WCED), (1987) Our common future. New York: Oxford University Press.



Figure 1-2 Scale of 19 Sustainability Indicator Systems (Lynch et al., 2011)²³

Berlin as the research case study

In Berlin as the capital city of Germany has more than one main urban center. In Berlin, also several boroughs or districts are composed of several localities that named as Kieze in German. In the first division of urban areas in Germany, Berlin had 23 boroughs. Since 2001, these urban districts have officially been merged together and decreased from 23 to 12 for improving organizational urban and regional proficiency as follows;

- Mitte
- Friedrichshain-Kreuzberg
- Pankow

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- Charlottenburg-Wilmersdorf
- Spandau
- Steglitz-Zehlendorf

²³ Lynch A. J., Andreason S., Eisenman T., Robinson J., Steif K. and Birch E. L. (2011) Sustainable urban development indicators for the United States, Report to the Office of International and Philanthropic Innovation, Office of Policy Development and Research, U.S. Department of Housing and Urban Development.

- Tempelhof-Scho neberg
- Neuko lln
- Treptow-Ko penick
- Marzahn-Hellersdorf
- Lichtenberg
- Reinickendorf

The time span of this research covers the period 2000-2010. The indicator data has been gathered for 12 districts of Berlin for each of the years: 2000, 2005, and 2010.

1.2 Problem statement

According to the existing reports and research outcomes, development in so many cities specifically "sprawled cities" in countries around the world has been influenced by global changes. Corporate governance, the information economy, the challenges of an ageing population, public transportation and strategic communication, modernizations as social and economic indicators, is the main area that needs to be developed sustainable. Therefore, sustainable development concept within these areas has been a significant indicator to design a suitable pattern to achieve sustainability in sprawled cities. (Deakin, 2003²⁴; Laffel, 2006²⁵; OECD, 2008²⁶; Gurran, 2011²⁷; Servaes, 2013²⁸) Migration and economic development

²⁴ Deakin, M. (2003) Developing Sustainable Communities: Impacts of a Sporting Event on a Provincial City: The Case of New Plymouth

²⁵ Laffel, N. (2006) Promoting Public Transportation for Sustainable Development, New Jersey: Princeton University.

²⁶ Organization for Economic Cooperation and Development (OECD), (2008) Competitive Cities and Climate Change

²⁷ Gurran, N. (2011) Australian Urban land use planning: Principles, systems and practice. (2nd ed.) Sydney University Press

²⁸ Servaes, J. (2013) Sustainable Development and Green Communication African and Asian Perspectives, London/ New York: Palgrave / MacMillan

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(Paper, 2013)²⁹; energy and resource use (Mensah and Castro, 2004³⁰; IAEA, 2005³¹; Lion and Moavenzadeh, 2003³²); poverty (UNEP, 2011a)³³ and globalization of economic activities (UNEP, 2011b³⁴; Zollinger, 2007³⁵) also are the other areas that need to study deeper to modify sustainability pattern. Based on the existing information, there are many of the cities in developed and developing countries that have been faced to main challenges of sustainable development particularly about environmental and human negative impacts (Sorensen et al., 2004).³⁶

According to the Kahn (2005)³⁷ as cited by Paek (2006)³⁸, the pattern for the urban development in sprawl cities, has been described by its speed, magnitude and intensity, along with postures both opportunities and threats for sustainable development. To realize sustainable development of sprawl cities, it is essential to study the interfaces of economic, environmental and social concerns occurring from urban development.

- ³⁰ Mensah, A.M., and Castro, L.C. (2004) Sustainable Resource Use and Sustainable Development a Contradiction, Retrieved January 10, 2013 from Center for Development [online] Available from: www.zef.de/fileadmin/downloads/forum/.../2004_3b_Mensah_Castro.pdf
- ³¹ International Atomic Energy Agency (IAEA), (2005) Energy indicators for sustainable development: Country Studies on Brazil, Cuba, Lithuania Mexico, Russian Federation, Slovakia and Thailand, United nations department of economic and social affairs.
- ³² Lion, S. and Moavenzadeh, F. (2003) Sustainable Development and Energy Consumption in Urban Transportation: A Need for Comprehensive Solutions, Proceedings of International Workshop on Policy Integration Towards Sustainable Urban Energy Use for Cities in Asia, 4-5 February 2003 (East West Center, Honolulu, Hawaii).
- ³³ United Nations Environment Program (UNEP), (2011a) Keeping Track of Our Changing Environment: From Rio to Rio+20 (1992-2012) United Nations Environment Program, Nairobi. Published October 2011, ISBN: 978-92-807-3190-3.
- ³⁴ United Nations Environment Program (UNEP), (2011b) Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication, www.unep.org/greeneconomy ISBN: 978-92-807-3143-9 Layout by UNEP/GRID-Arendal
- ³⁵ Zollinger, U. (2007) The Effects of Globalization on Sustainable Development and the Challenges to Global Governance, Paper on behalf of the Swiss Agency for Development and Cooperation (SDC) on the occasion of the Certificate Course "Sustainable Development" at the University of Berne.
- ³⁶ Sorensen, A., Marcotullio, P. J., and Grant, J. (2004) Towards sustainable cities: East Asian, North American and European perspectives on managing urban regions (pp.3-23), Burlington, VT: Ashgate.
- ³⁷ Kahn, M. (2005) Green cities: Environmental challenges posed by urban growth. Unpublished paper, Tufts University. Retrieved November 20, 2005, from http:// www.owlnet.rice.edu/~econ461/papers/greencities.pdf

³⁸ Paek, S. (2006) Urban Growth Pattern and Sustainable Development, Texas A&M University

²⁹ Paper, D. (2013) Migration and Sustainable Economic Development, Deutsche Gesellschaft fu r Internationale Zusammenarbeit (GIZ) GmbH

Urban growth affects on various aspects of cities, including natural environment use, transportation networks, environment, economic growth, and housing. Consequently, in order to better understanding the influences of urban development, a multi-criteria model is needed in that urban development has both positive and negative effects for sprawled cities in different areas.

The existing literature review presents the various models of urban development are able to create different impacts on sustainability. Obviously, there is rapid growth of cities in developed and developing countries that need to define proper models on sustainability to mitigate negative impacts of rapid urbanization as shown in Figure 1.3.



One of the major flaws of the existing models for evaluation of urban development from the perspective of sustainability is the lack of coverage of all parameters affecting the sus-

Human and Environmental (Nsiah-Gyabaah, 2003) 39

³⁹ Nsiah-Gyabaah K. (2003) Urbanization, environmental degradation and food security in Africa, the global environmental change research community, Montreal, Canada, 16-18 OCTOBER 2003