

Challenges of mega construction projects in developing countries

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Research Paper

MEGA CONSTRUCTION PROJECTS (MCPs) REPRESENT A STRATEGIC OPTION TOWARDS ACHIEVING SUSTAINABLE DEVELOPMENT OBJECTIVES IN DEVELOPING COUNTRIES. On the one hand, these projects are characterised with the need for high design knowledge and technical skills; competent human resources and managerial capabilities as well as excessive cost investment. Conversely, developing countries experience shortage of many of these requirements, which obstruct the development of (MCPs). This paper aims to identify, validate, and classify the challenges of delivering (MCPs) in developing countries. Towards achieving this aim, two approaches were employed, namely literature review and case studies, to accomplish four objectives.

- Reviewing the nature and characteristics of developing countries and (MCPs); identifying the challenges of delivering (MCPs) in developing countries and establishing the need for (MCPs) in developing countries.
- Validating the challenges identified from Literature review through collecting and analysing 36 case studies of (MCPs) in developed countries. Case studies confirmed many of the identified challenges and added new insights that were not covered in current literature.
- Classifying the identified challenges into four categories: engineering challenges, human development challenges, managerial and political challenges and sustainability challenges.
- Outlining research conclusions and recommendations useful for delivering successful (MCPs) in developing countries.

Keywords

Mega Construction Projects, Challenges, Sustainable Development, Developing Countries.

INTRODUCTION

Governments in developing countries, where approximately 85.4% of the world's population lives in, develop (MCPs) to achieve their social and economic sustainable development objectives (Human Development Report, 2011; Zeybek and Kaynak, 2006; Cohen, 2006). This is accomplished through constructing infrastructural, industrial, educational, cultural, transportational, medical, and residential projects that provide societies with their needs and fulfil their requirements (Othman, 2012; Khan, 2008; Mthlane et al., 2007; Field and Ofori, 1988). (MCPs) are complex, risky and time-consuming undertakings that are usually commissioned by governments and delivered by national and international participants with a variety of cultural differences, backgrounds, political systems, and languages (Shore and Cross, 2005). They attract high levels of public attention and political interest due to the substantial cost, direct and indirect impact on the community, environment, and budgets (Van Marrewijk et al., 2008; Capka, 2004). On the one hand and due to their unique nature and characteristics, (MCPs) require high design knowledge and technical skills, competent human resources, professional managerial capabilities and large-scale investment (Sturup, 2009; Frick, 2006; Flyvbjerg, et al., 2003). In contrast, developing countries suffer from having shortage in providing these essential knowledge, skills, capabilities, and finance, which ultimately challenge the development of (MCPs). Towards assisting governments in developing countries achieving their sustainable development objectives, this paper aims to identify, validate and classify the challenges of delivering (MCPs) in developing countries.

Research Objectives and Methodology

To achieve this aim, a research methodology, consists of literature review and case studies, is developed to accomplish four objectives.

- ▶ Firstly, building a comprehensive background of the research topic including (1) nature and characteristics of developing countries and (MCPs), (2) identifying of challenges of (MCPs) in developing countries and underlining the necessity of (MCPs) in developing countries as an approach for achieving sustainable development objectives. This objective was achieved through literature review depending on textbooks, academic journals and professional magazines, conference and seminar proceedings, dissertations and theses, organisations and government publications as well as Internet and related websites.
- ▶ Secondly, validating the challenges identified from literature review through collecting and analysing 36 case studies of (MCPs) (either completed, under development, on hold or cancelled) in developing countries worldwide. The use of case studies confirmed many of the identified challenges and added new insights, which were not covered by current literature. These new insights were specific to the culture of the analysed projects and their societies. Although, literature review and case studies confirmed 31 out of 45 challenges, which highlighted their importance and increased their credibility, other challenges that were merely identified by literature review are also of value to construction literature. By using more than one source of evidence (literature review and case studies), it was possible to improve the validity of the collected challenges and increase background knowledge. In an effort to ensure the reliability of the data, data collection concentrated on facts and events, rather than highly subjective interpretations (Yin 1989; MacPherson et. al 1993). Literature review and case studies resulted in the identification of 65 challenges of delivering (MCPs) in developing

countries. The work was reviewed and refined by the author on regular basis to omit repeated challenges and merge similar ones. The result was 45 challenges.

- ▶ Thirdly, classifying the challenges of (MCPs) based on their nature into four categories, namely Engineering Challenges, Human Development Challenges, Managerial and Political Challenges, and Sustainability Challenges.
- ▶ Finally, outlining research conclusions and recommendations useful to delivering (MCPs) in developing countries.

Case Study Sampling

The objective of case study sampling was to select a representative and non-biased sample of (MCPs) from which to identify the challenges that obstruct their development in developing countries. (MCPs) is a new area of research in construction literature (Brockmann and Girmscheid, 2007). In addition, the interest of the research community in megaprojects has begun to grow (e.g. the International Journal of Project Management's special issue on "Complexities in Managing Mega Construction Projects," October 2011 and Organization, Technology and Management in Construction: An International Journal's special issue on "Megaproject Management," December 2012). As a result, many areas of megaproject management remain largely uncharted such as challenges of their delivery in developing countries, which made it difficult to select the case study sample and obtain relevant resources. To overcome this issue, the principal list of (MCPs) developed worldwide was collected from available literature and related websites which consisted of (348) projects. The collected projects excluded non-construction projects such as (Information Technology, Military, Science, Oil and Gas projects) as they are beyond the scope of this research. Once the list has been com-

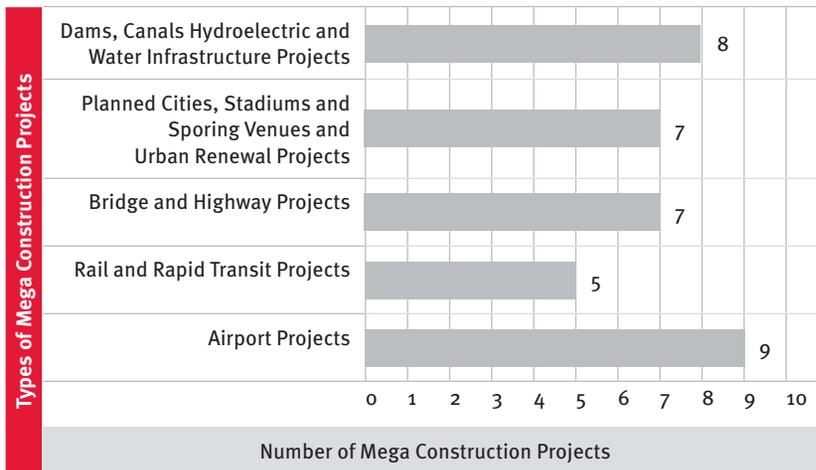


Figure 1 Types and Numbers of Surveyed (MCPs) in Developing Countries

piled, the (MCPs) (either completed, under development, on hold or cancelled) in developing countries were extracted which were 100 projects. Due to lack of resources and difficulty accessing information regarding these projects, only 36 case studies were successfully collected and analysed, representing 36% of (MCPs) projects in developing countries. Detailed information focused on project's type, location, cost, duration, and challenges. This sampling methodology has, effectively covered developing countries worldwide, so the identified challenges were extracted from different projects constructed in different countries, with different scope, regulations, client organisations, cost, duration, all of which enhanced the reliability and validity of the identified challenges, see figure (1) and table (1) in appendix (A).

Literature Review

Overview and Characteristics of Developing Countries

The distinction between “developed” and “developing” countries is a continuous issue and is surrounded by fierce debate (Moohebat et al., 2010). Generally, the classification of a country as “developed” or “developing” is based on certain measures such as

(1) economic development, (2) education and training provision, (3) political stability, technological development, infrastructure and production rate, (4) healthcare, life expectancy and growth rate of population, and (5) society, demography and culture issues. Economically, the World Bank (2012) classified countries into four income groups based on their Gross National Income (GNI) per capita. All low, lower, and upper middle-income countries are classified as developing countries as follows:

- ▶ Low income countries
GNI \leq US\$ 1,025 per capita
- ▶ Lower middle income countries
GNI = US\$ 1,026 - US\$ 4,035 per capita
- ▶ Upper middle income countries
GNI = US\$ 4,036 - US\$ 12,475 per capita
- ▶ High income countries
GNI = US\$ 12,476 and above per capita

Recently the United Nations (UN) developed another measure, the Human Development Index (HDI), which combines there basic dimensions of human development, namely “long and healthy life”, “knowledge” and “decent standard of living”, to gauge the level of human development of countries (Human Development Report, 2011) as follows.

- ▶ Low human development
HDI below 0.500
- ▶ Medium human development
HDI = 0.500 – 0.799
- ▶ High human development
HDI = 0.800 - 0.899
- ▶ Very high human development
HDI = 0.90 and above

52% of the world's population live in countries with “medium human development,” while 18% populate countries falling in the “low human development” category. Countries with “high” to “very high” human development account for 30% of the world total population. Table (2) summarises the remaining characteristics of developing countries.

Nature and Characteristics of (MCPs)

Different terms are used in literature to describe large projects such as complex projects, major projects, giant projects, new animals and mega-projects (Ruuska et al., 2009; Grun, 2004; Flyvbjerg, et al., 2003). While such projects are large, they are not unparalleled in history (Brockmann and Girmschied, 2007). There are several different statements that claim to be a definition of (MCPs) and there are different perspectives on what (MCPs) are. However, all these definitions and perspectives agree that (MCPs) are huge investment projects aimed at supporting governments achieving their social and economic development objectives. (MCPs) attract public and political attention due to their substantial impacts on communities, environment and budgets (Van Marrewijk et al., 2008; Capka, 2004). In addition, (MCPs) are owned by governments and executed by large construction firms. Furthermore, (MCPs) are risky undertakings that consume substantial amount of time, cost and requires highly trained design and construction professionals as well as skilled managerial team. Table (3) summarises the characteristics of (MCPs).

No.	Table (2) Characteristics of Developing Countries	Authors	
Characteristics related to Education, Training and Brain Drain			
1	Low standard of education and vocational training	(Connexions, 2012; WDR, 2012; Kumar, 2012; Economics, 2010; Kintu, 2008)	
2	Out flow of best brains		
Characteristics related to Policy, Economy, Technology, Infrastructure and Production			
3	Corruption and political instability	(Economic Concepts, 2013; Connexions, 2012; Kumar, 2012; Economics, 2010; Bobrova and Kalvina, 2004; Fry, 1998)	
4	Lack of capital and technology		
5	Dualistic economy		
6	Vicious Circle of Poverty		
7	Low levels of productivity		
8	Inequalities of national income distribution		
9	Inadequate infrastructure		
10	Heavy dependence on agricultural production		
11	External resources dependence		
12	Lack of industries and enterprises		
13	Underutilized natural resources		
14	High and rising levels of unemployment and under-employment		
Characteristics related to Health Care, Life Expectancy and Growth Rate of Population			
15	Poor health care		(Economic Concepts, 2013; WDR, 2012; Connexions, 2012; Kumar, 2012)
16	Low life expectancy		
17	High rates of population growth and dependency burdens		
Characteristics related to Society, Demography and Culture			
18	General and social backwardness	(Economic concepts, 2013; Bobrova and Kalvina, 2004)	
19	Demographic characteristics		
20	Socio-cultural characteristics		

Table 2 Characteristics of Developing Countries

Identification of Challenges of delivering (MCPs) in developing countries

In order to assist developing countries achieving their sustainable development objectives and overcoming the challenges that hinder the development of (MCPs), these challenges have to be identified. Literature review and case studies identified 65 challenges of developing (MCPs) in developing countries. These challenges were reviewed and refined by the author on regular basis to omit repeated challenges and merge similar ones. The result was 45 challenges. Table (4) lists the identified challenges and indicated whether these challenges were identified from literature, case studies or both.

Classification of Challenges of delivering Megaprojects in developing countries

Based on their nature, the identified challenges were classified into four categories, namely, (1) Engineering Challenges, (2) Human Development Challenges, (3) Managerial and Political Challenges and (4) Sustainability Challenges. Because of the fact that many challenges resulted from more than one factor, many of these challenges fall under more than one classification category, see table (5) in appendix (B).

The Rationale behind the Challenges of Developing (MCPs) in Developing Countries

Many of the challenges that were identified through literature review were confirmed by analysis of the case studies as shown in table (2). These challenges can be classified into 4 categories and the rationale behind their occurrence investigated in order to identify their impact on developing (MCPs) in developing countries.

Rationale behind Engineering Challenges (No's. 1, 2, 3, 5, 20, 22, 23, 24, 36, 37, 38, 42 & 45)

Engineering challenges that face the development of (MCPs) in developing countries are classified as design challenges and technical challenges. Due to their nature, the development of

No.	Table (3) Characteristics of (MCPs)	Authors
Characteristics related to Project Nature, Objective, Location, Time, Cost, and Risk		
1	Colossal in size and scope physical infrastructure / capital asset with a life span measured in decades in order to plan, design, finance and build	(Sanderson, 2012; Sturup, 2009; Frick, 2006; Bruzelius et al., 2002)
2	Located in remote and/or inhospitable areas	(Flyvbjerg, et al., 2003; Haynes, 2002).
3	Costly and often under estimated projects that require high investment expenditures of: US\$1 billion or more	(Sturup, 2009; Frick, 2006; Flyvbjerg, et al., 2003; Bruzelius et al., 2002)
	£150 million as a bench mark cost	(Sturup, 2009)
	EUR 0.5 billion and more	(Megaproject Cost Action, 2012)
4	Controversial and often have financing difficulties	(Sturup, 2009; Frick, 2006; Haynes, 2002)
5	Risky undertakings, especially when: project priorities and objectives changed	(Ruuska et al., 2009)
	project extends over its economic cycles	(Jia et al., 2011; little, 2011)
	shortage of labour and suppliers	(Haynes, 2002)
	lack of planning and cost estimate	(Keegan, 2004; Bruzelius et al., 2002)
	poor technology and traditional delivery methods	(Jia et al., 2011; little, 2011)
Characteristics related to Client(s) and Performing Organisation Structure		
6	The client is often a government or public sector organisation	(Kardes, et al., 2013; Sanderson, 2012; Ruuska et al., 2009; Shore and Cross, 2005; Haynes, 2002)
7	The main contractor or consortium of contractors are usually privately owned, financed and often from various countries with variety of cultural differences, backgrounds, political systems, and languages, seeking success with different objectives	
8	Complex management structure and the matrix and project organisational forms are used interchangeably	(Kerzner, 2003; Stoddart-Stones, 1988).
9	Insufficient experience of performing organisation in managing complex undertakings	(Keegan, 2004; Haynes, 2002)
10	Continuous organizational restructuring may be necessary as each project goes through a different life-cycle phase	(Kerzner, 2003)
11	The performing company often retains an ownership stake in the project after completing the construction phase in a special purpose vehicle and is paid by the client for the service that flows from the asset's operation or use over a number of years	(Sanderson, 2012)
Characteristics related to Engineering Design and Technical Requirements		
12	Complex projects that demand high design knowledge, professional technological skills and logistical support	(Sturup, 2009; Frick, 2006; Flyvbjerg, et al., 2003)
13	Necessitates multidisciplinary contributions from various organizations	
14	Long termed projects that require program planning, control and highly trained employees especially in the field of Project Management	(Sturup, 2009; Kerzner, 2003)
15	Requires clearly defines rules and procedures as well as effective communication at all levels	
16	Requires quality front-planning	
17	Projects' captivation due to their size, engineering achievements and aesthetic design call for virtual enterprise for the implementation of the project through exploiting fast-changing opportunities and confronting problems as early as possible	(Sturup, 2009; Frick, 2006; Flyvbjerg, et al., 2003)
Characteristics related to Environment, Society, Economy and Policy		
18	Public acceptance / opposition due to the social, economic, political and environmental impacts	(Ruuska et al., 2009; Haynes, 2002)
19	Politics are playing an important role in how senior management appointments and activities are defined.	(Haynes, 2002; Stoddart-Stones, 1988)
20	Poor risk analysis and inappropriate identification of the project consequences	(Hopkinson, 2007)

Table 3 Characteristics of (MCPs)

(MCPs) requires unique design knowledge, skills, and experience. Lack of professional expertise, shortage of full understanding of scientific and technical requirements (Georgieva, 2012) and improper decisions and overlooking specialists and stakeholders consultation during the decision making process (Kerzner, 2006; Jia et al., 2011) obstruct the development of (MCPs) in developing countries. These challenges were clearly noticed in Toshka project, a water infrastructure development, Egypt as not all technical requirements have been taken into full consideration and the different studies conducted over the years related to the project have not been discussed openly and in public, see figure (2). Examples of the technical failure include:

- ▶ The high level of saline in the Western Desert's and the presence of underground aquifers acted as a major hindrance to any irrigation project. As the land is irrigated, the salt mixes with the aquifers and reduces access to potable water.
- ▶ The clay minerals found in the soil are also posing technical problems to the big-wheeled structures moving around autonomously to irrigate the land. These wheels get stuck in a little bowl created by wet clay that dried, and the irrigation machines come to a standstill (Deputy, 2011).
- ▶ One of the main problems that affect the performance of the Great Man-made River in Libya is the rust of water pumps and corrosion of steel pipes installed in this project. This is a result of ignoring the warning of the specialised Danish provider of the equipment about the excessive use of chlorine in water purification. Consequently, the project administration decided to reduce the water pressure in these pipes and looked for replacing the installed pumps.
- ▶ Lack of design experience and poor management capabilities play a significant role towards misunder-

standing client requirements and incomplete achievement of project objectives (Georgieva, 2012). In addition, these shortcomings have negative impact on the project through specifying materials that are outdated, no longer produced or available in the market (Tenah, 1985). In turn, project stakeholders change project requirements at later stages of the project life cycle. An example of these challenges is in a case study of 400 housing projects designed by a foreign consultant, who did not adequately understand the culture and traditions of the end-users. After the practical completion stage of the project, the users carried out significant changes in order to meet their requirements such as privacy and the ability to add more rooms for future increase in their family sizes (Othman et al., 2004).

- ▶ Lack of research capacity for addressing contemporary social and environmental problems as well as lack of private business investment in innovation and providing new and improved processes and product hinders the development of (MCPs) in developing countries (Georgieva, 2012). This is because the private sector has the potential and experience towards assisting governmental organisations achieving sustainable development objectives (Othman and El-Gendawy, 2012).
- ▶ Strategic project planning, effective leadership and proper application of project management knowledge and skills as well as utilising the experience and competency of client and contractor organisations enabled a small group of Malaysian Professionals to deliver successfully Kuala Lumpur International Airport (KLIA) project to the Government of Malaysia within seven years from the word 'go' at lower cost by Ringgit Malaysian 11 billion (RM 1 = US\$ 0.32) with full commitment on time completion without sacrificing architectural

beauty, functionality and quality. Professional project managers were able to manage complexity and run 205 different contract packages concurrently and deliver the first ever airport to successfully develop, design and implement a fully integrated IT airport management system (Hussein and Karimin, 2006).

- ▶ Kerzner (2006) stated that improperly defined rules and procedures and shortage of using prior experience to review contingencies obstruct the achievement of (MCPs) objectives in developing countries. This is because these challenges lead to loss of effort and responsibility as well as manage unforeseen events. In addition, poor quality front-end planning can deteriorate the whole quality management process and lead to delivering projects that do not meet client and user expectations.

Rational behind Human Development Challenges

(No's. 8, 11, 12, 15, 17, 18 & 43)

- ▶ The ability to attract, retain and develop talented employees is a key feature of successful business. People are an organisation's most valuable asset and this is especially true in relatively low-tech, labour-intensive industries such as construction (Loosemore et al., 2003). Labours are the lifeblood of any construction project, especially (MCPs) in developing countries. They are the workforce that creates the final product. Therefore, it is imperative to improve their skills and enhance their abilities to increase the productivity of the construction industry and ensure the quality of the constructed projects (Ramburan and Othman, 2007).
- ▶ Shortage of providing quality education and professional training programmes is a major challenge that leads to lack of providing (MCPs) with high-qualified human resources, which have the right skills that match

with project demands and geography. In addition, lack of human resources development in management related disciplines (i.e. project management, contract administration, leadership) results in poor supply of experienced staff who can accept critical roles, which they are not, prepared for (Georgieva, 2012). Furthermore, there is an agreement between academics and professionals that academic institutions do not equip graduates with necessary skills required to meet the requirements of the construction industry (Nkado, 2000; Chileshe and Haupt, 2007; Rwelamila, 2007) which highlights the need for human resource development.

- ▶ The construction of the 2010 FIFA World Cup stadia in South Africa is a clear example that explains the impact of the shortage of skilled labour on delivering (MCPs) in developing countries. Baloyi and Bekker (2011) stated that shortage of skilled labour was ranked the third out of nine causes of cost overrun (with Relative Importance Index = 0.58 out of 1) and the second out of nine causes of time delays (with Relative Importance Index = 0.63 out of 1).
- ▶ Another example is the development of Nelson Mandela Bay Metropole in South Africa where 100,000 specially designed dwellings of high architectural and engineering quality need to be constructed in 3-5 years to wipe out the backlog 2 million homes. Failing to provide skilled labour and properly trained on-site supervisors who are capable to deliver the required standard of work leaving delivery of homes to unreliable contractors was a major challenge towards achieving the project objectives (Koen and Theron, 2008).

Rationale behind Managerial and Political Challenges
(No's. 4, 6, 7, 9, 10, 12, 13, 16, 19,

21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 34, 35, 39 & 44)

▶ Al-Maghraby (2012) and Georgieva (2012) stated that “Bureaucracy and corruption practices”, “Lack of political support” and “Leadership problems” are main challenges of delivering (MCPs) in developing countries. When the country’s leadership lacks vision of the future, careless, selfish, bureaucratic and corrupted, it opens the gate of stealing the economy, losing and depressing people, and lacking of control on the future. In addition, corruption practices create a business environment unfavourable to innovation. Failing to develop (MCPs) prevent developing countries form promising projects that could take the whole country to new levels. Some examples that ascertain these challenges are:

- The Egypt - Saudi Arabia Bridge which supposed to be inaugurated back in 2007, was unexpectedly cancelled by the government without explanation, despite the offered funds from the Saudi side.

- The Western Desert New Axis Project that proposed a geography reformation project in order to help spreading the condense around the Nile valley through constructing a new axis, extending from Nasser lake to the Mediterranean sea by building a high transportation way, railroad, electricity stations, multiple horizontal connections with the original valley, was halted.

- Egypt Space Programme which started decades ago was an ambitious program for space scientific activities to put Egypt on the space map was stalled due to funding issues, careless and inattentive behavior of those supervising the programme.

- The lack of political support and inefficiency froze the development of Chile’s biggest multi-dam project (Merco Press, 2013) and delayed the Bandra–Worli Sea Link project, India

about 5 years and increased its cost by 430%.

▶ Political stability is the key to social and economic development in any country. It is vital for attracting foreign investment and constructing development projects (Dollerya and Worthingtonb, 1996). East Asian countries such as Malaysia, Thailand and Singapore registered sustained economic growth rates largely due to substantial foreign investment flows (Mansur et al., 2011). As an example of the negative impact of political instability on (MCPs) development is shown in the tensions between Turkey, Syria and Iraq which is raised from time to time due to South-eastern Anatolia Project (SAP) initiated in Turkey. Syria and Iraq demanded more water to be released, while Turkey declined so as to form the dam reservoirs. Almost came to a complete halt in the early 1990s due to the high level of Kurdish terrorists’ activities in the region. The Kurdish activities are not only blamed for a number of funding cuts as funds were diverted to support the counter-terrorism effort, but is also blamed for damaging several dams and canals, as well as killing engineers working at the dams (GAP, 2011). Another example is Lahore Ring Road, Pakistan, where changes in government and lack of professional capabilities of governmental departments caused delay, change in project requirements and shot up the estimated cost.

▶ In addition, political imperatives and authority misuse through laying of public funded projects in the hands of politicians accompanied with the pressure forced by project authorisation on individuals obstruct the development of (MCPs) in developing countries (Hopkinson, 2007). According to Toor and Ogunlana (2006), a number of challenges have been raised during the development of the Second Bangkok International Air-

port, Thailand such as poor communication and coordination interface management between project stakeholders due to language barrier; lack of experience of project team; difference in local construction practices; lack of cooperation of government agencies; lack of foremen's experience and knowledge and bureaucratic behaviour of the employer. This necessitated that different leadership styles such as revolutionary, resolving, reverent and rewarding could be used to improve the skills of managers of (MCPs).

- ▶ Lack of government decisions to strike a balance between short- and long-term objectives and effective risk mitigation (Procaccini et al., 2012) resulted in constructing the Long Thanh International Airport, Vietnam during the Vietnam War in a crowded neighbourhood to support war transportation and hence future expansion is limited and unsafe.

Rationale behind Sustainability Challenges (No's. 4, 6, 14, 18, 19, 21, 25, 30, 33, 35 & 40)

- ▶ "Lack of financial resources, cost control and venture capital" is a common challenge that hinders the development of (MCPs) in developing countries (Georgieva, 2012; Jia et al., 2011). This issue is a result of low country's Gross Domestic Product (GDP), lack of financial resources and poor management of country's assets. Suramadu Bridge, Indonesia and Toshka project, Egypt are two examples of this challenge. While the construction of the first project began on 2003 by a consortium of Indonesian and Chinese companies with a total cost of US\$445 million (Witular, 2009), the bridge was halted at the end of 2004 due to lack of funds, but was restarted and completed by 2009. Likewise, while Toshka's total budget has been estimated to be US\$ 87 billion, Deputy (2011) stated that less than 25% of the original budget

has been spent already, but the results are piecemeal. Astonishingly, a feasibility study of the project was only prepared in May 1998, about 17 months after establishing of the project (The Egyptian Gazette, 2011).

- ▶ Russky Bridge, Russia is an example of the challenge of "naïve risk analysis and inappropriate identification of the project consequences" (Hopkinson, 2007). The bridge was widely criticized by Russian political opposition as the cost of the bridge is three-times more than the budget of preparing the city of Primorsky Krai to host Asia-Pacific Economic Cooperation (APEC) Leaders' Summit. On the one hand, the project costs US\$1 billion and services a population of only 5,000 inhabitants. On the other hand, the throughput of the bridge is 50,000 cars per day which many times exceed the existing population. Another criticism of the project is the fact that the paved road ends in a dead end just beyond the bridge when local residents who live on the other side of the island have no access to telephones, public lighting or running water (CBC News, 2012).
- ▶ Being the largest earth filled dam in the world and second largest by the structural volume, the construction of Tarbela Dam, Pakistan in 1976 submerged 135 villages, which resulted in displacement of a population of about 96,000 people. Although a cash compensation of Rs 469.65 million (Rs 1 = US\$ 0.01015) was paid to the affected people, the absence of a national policy showed that many affected of the project have still not been settled and not been given land as compensation by the Government of Pakistan as agreed with the World Bank (Pakistan & Gulf Economist, 1999).
- ▶ Lack of considering environmental requirements, preserving historical sites, and natural reserve are sustainability challenges that face the

development of (MCPs) in developing countries. Amongst the projects that threaten the environment and endanger the biodiversity and historical sites are the (MCPs) being developed in Ethiopia (Walta info, 2013), Lakhta Centre, St. Petersburg, Russia (UNESCO, 2012), Belo Monte Dam, Brazil (Fearnside, 2006) and Cahora Bassa Dam, Mozambique (Beilfuss and dos Santos, 2011). Positively, the Mexico's government cancelled a controversial mega-resort development in Baja California Sur after environmentalists stated that it would have threatened a large coral reef in the Sea of Cortes that has rebounded dramatically from years of damage (Hernandez, 2012). Another example that shows the inappropriate identification of project consequences is the cultural damage that resulted from the vibration caused by the Tehran Metro, Iran to historic sites such as Golestan Palace and the national museum of Iran.

- ▶ Lack of managing social complexity in terms of accepting the project by the community in which the project is intended to serve and the large number of project participants with different culture, knowledge and skills as well as diverse objectives is a challenge that affects the development of (MCPs) in developing countries. This challenge is reinforced by poor working condition, ignoring health and safety considerations as well as the absence of activating health and safety acts, which have dire social and economic consequence (Othman, 2012). One example that explains this issue is the re-location of the Kuala Namu International Airport, Indonesia to a more appropriate site away from residential areas due to crash of a flight in 2005 causing the death of officials and residents in areas around the airport area.

No.	Challenges of Developing Megaprojects in Developing Countries	From Literature Review	From Case Studies
1	Lack of design knowledge and experience related to (MCPs) (Georgieva, 2012; Deputy, 2011).	X	Case (1)
2	Lack of professional expertise and full consideration of technical requirements (Georgieva, 2012; Deputy, 2011).	X	Cases (1&8)
3	Misunderstanding and partial achievement of project objectives (Georgieva, 2012)	X	
4	Lack of financial resources, cost control and venture capital (Al-Maghraby, 2012; Georgieva, 2012; Jia et al., 2011; Witular, 2009)	X	Cases (1,9,16, 19&22)
5	Lack of research capacity and business innovation (Georgieva, 2012)	X	
6	Missing Intermediary bodies (Georgieva, 2012)	X	
7	Unfavourable regulatory framework (Georgieva, 2012)	X	
8	Lack of providing and managing high-qualified human resources (Georgieva, 2012; Baloyi and Bekker, 2011; Koen and Theron, 2008)	X	Cases (11&12)
9	Bureaucracy and corruption practices (Al-Maghraby, 2012; Georgieva, 2012)	X	Case (17)
10	Lack of political support and inefficiency (Merco Press, 2013, Al-Maghraby, 2012; Georgieva, 2012)	X	Cases (2,9, 10,17,20&22)
11	Difficulty resourcing the right skills and matching with project demands and geography (Procaccini et al., 2012; Baloyi and Bekker, 2011).	X	Case (11)
12	Lack of experienced staff to accept critical roles which they are not prepared for (Procaccini et al., 2012; Koen and Theron, 2008)	X	Case (12)
13	Governance decisions fail to strike a balance between short- and long-term objectives and effective risk mitigation (Procaccini et al., 2012)	X	Case (34)
14	Improper identification and engagement of various stakeholder groups in the early project phases (Procaccini et al., 2012)	X	Case (15)
15	Tight service market and lack of internal capacity (Procaccini et al., 2012)	X	
16	Improper implementation of project management processes and training of key project staff (Procaccini et al., 2012; Hussein and Karimin, 2006)	X	Case (29)
17	Lack of available on-site skilled workers or local labour forces (Baloyi and Bekker, 2011; Kerzner, 2006)	X	Case (11)
18	Lack of properly trained on-site supervisors (Koen and Theron, 2008; Kerzner, 2006;)	X	Case (12)
19	Huge numbers of people and organisations of different specialties involved in mega projects development (Kerzner, 2006)	X	
20	Ill-defined rules and procedures as well as inappropriate use of prior experience to review contingencies (Kerzner, 2006)	X	
21	Inadequate communication at all levels and poor coordination interface management between project stakeholders (Kerzner, 2006; Toor and Ogunlana, 2006)	X	Cases (28&31)
22	Lack of quality front-end planning (Kerzner, 2006)	X	
23	Improper decision making and overlooking specialists and stakeholders consultation during the decision making process (Jia et al., 2011; Kerzner, 2006; Toor and Ogunlana, 2006).	X	Case (28)
24	Lack of construction material availability (Tenah, 1985)	X	
25	Ignorance of health and safety considerations as well as the absence of activating health and safety acts (Othman, 2012)	X	Case (31)
26	Weak governance of project management (Hopkinson, 2007; Hussein and Karimin, 2006)	X	Case (29)

27	Political imperatives and authority misuse (Hopkinson, 2007; Toor and Ogunlana, 2006)	X	Cases (8&28)
28	Lack of exploiting uncertainties (Hopkinson, 2007)	X	
29	Project authorisation pressures on individuals (Hopkinson, 2007)	X	
30	Failure to invest sufficiently before the project's main authorisation point (Hopkinson, 2007)	X	
31	Unachievable targets cause sub-optimal project outcomes (Hopkinson, 2007)	X	
32	Lack of efficiency and effectiveness of the Project Management process (Hopkinson, 2007; Hussein and Karimin, 2006)	X	Case (29)
33	Naïve risk analysis and inappropriate identification of the project consequences (CBC News, 2012; Hopkinson, 2007)	X	Cases (18,27)
34	Inappropriate behaviour of the client organisation (Altman, 2005) and absence of national policy to resettlement of affected people	X	Case (6)
35	Lack of considering environmental requirements, preserving historical sites, and natural reserve (Walta info, 2013; UNESCO, 2012; Hernandez, 2012; Fearnside, 2006; Best & De Valence, 1999)	X	Cases (3,5,7 13,14& 17)
36	Ineffective project management and poor use of experience and competency of client and contractor organisations (Hussein and Karimin, 2006)	X	Case (29)
37	Lack in managing complexities of work content and work processes (Hussein and Karimin, 2006)	X	Case (29)
38	Lack of strategic project planning and ineffective leadership (Hussein and Karimin, 2006)	X	Case (29)
39	Leadership problems (Merco Press, 2013; Al-Maghraby, 2012)	X	Cases (2,9,10& 17)
40	Lack of managing social project complexity (Brockmann and Girmschied, 2007)	X	
41	Lack of managing cultural project complexity (Brockmann and Girmschied, 2007; Othman et al., 2004)	X	Case (15)
42	Inappropriate level of scientific and technological knowledge and application required (Jia et al., 2011; Deputy, 2011)	X	Case (1)
43	Lack of providing quality education and professional training programmes (Baloyi and Bekker, 2011; Naidoo et al., 2009)	X	Cases (11&12)
44	Political tension between countries (GAP, 2011)	X	Case (4)
45	Stakeholders change project requirements at later stages of the project life cycle (Othman et al., 2004)	X	Case (15)

Table 4 Challenges of (MCPs) in Developing Countries

CONCLUSIONS AND RECOMMENDATIONS

This paper investigated the characteristics of developing countries and (MCPs) and aimed to identify, validate and classify the challenges that encounter the development of these projects in developing countries. Governments in developing countries construct (MCPs) as a strategic means for achieving sustainable development objectives such as infrastructure, healthcare facilities, educational institutions, human and economi-

cal development projects. On the one hand, (MCPs) require high design knowledge and technical skills; competent human resources and managerial capabilities as well as high cost investment. On the other hand, developing countries are characterised with (1) low standard of education, training and out flow of best brains, (2) corruption and political instability, dearth of capital, outdated technology and low levels of production, (3) poor health care, low life expectancy and high growth rate of population, (4) difficulties related to social, demographic and cul-

ture. All of which hindered the development of these essential projects. Literature review and case studies identified 45 challenges that obstruct the development of (MCPs) in developing countries. These challenges were classified into four categories of Engineering Challenges, Human Development Challenges, Managerial and Political Challenges and Sustainability Challenges. Towards overcoming these challenges and assisting governments in developing countries developing (MCPs), the research recommends the following strategies.

► **Strategies for Education and Training:**

Governments in developing countries have to perceive that providing quality education and professional training is a key driver towards sustainable development and prosperity. Higher percentage of the countries' (GDP) has to be spent to improve education, research and development. This will help equipping human resources with state-of-the-art knowledge and technical expertise needed to overcome the engineering and human development challenges of delivering (MCPs) in developing countries. In addition, offering competitive packages and job opportunities will attract scientists and bright students who completed their higher studies to remain / return back to benefit their countries.

► **Strategies for Policy, Economy, Technology, Infrastructure and Production:**

A number of strategies have to be adopted by governments in developing countries to improve their situation and increase the chance of developing successful (MCPs). These strategies include establishing political stability, eradicating corruption, encouraging economic, and technological development, constructing infrastructure facilities and increasing productivity. This will be reflected positively on improving public morality and encouraging people to create ideas that lead to growth and improvement. In addition, these strategies will encourage internal and external investment and secure financial resources needed for developing (MCPs) and reduce the heavy dependency on low agricultural production and decrease the level of unemployment and increase (GDP).

► **Strategies for Healthcare, Life Expectancy and Growth Rate of Population:**

Developing countries have to fight a battle against malnutrition, diseases and ill-health care. Governments in developing are responsible for pro-

viding their people with appropriate health care and services, safe drinking water and sanitation facilities. In addition, increasing the percentage of (GDP) spent on improving the health care sector will provide hospitals with sufficient doctors and facilities for the number of inhabitants of these countries and consequently increase people's life expectancy, decreasing death rate of babies at birth and in early infancy. Furthermore, through adopting the abovementioned strategies, the high growth rate of developing countries will be an advantage to these countries and lifeblood towards developing (MCPs).

► **Strategies for Society, Demography and Culture:**

Governments in developing countries, which often ruled by the Military, are encouraged to support democratic transition and activate the role of civil society organisations and cultural change. This will help building trust between governments and their societies in addition to improving people's attitude towards adapting to challenges facing their countries. Moreover, these strategies will change politicians' corruption and misuse of their power as well as reduce the frauds, dishonesty and embezzlements that are very common in governmental departments. All of which assist in overcoming the political and managerial challenges of developing (MCPs) in developing countries.

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Table (1) Name, Location, Estimated Budget & Development Status of Case Studies

Dams, Canals, Hydroelectric and Water Infrastructure Projects				
Case No.	Project Name	Location	Estimated Budget	Development Status
Case (1)	Toshka Project	Egypt	US\$ 87 Billion	Under Development
Case (2)	Chile's biggest multi-dam project	Chile	US\$ 7 Billion	Under Development
Case (3)	Mexico mega-resort Development	Mexico	US\$ 1.5 Billion	Halted
Case (4)	South-eastern Anatolia Project	Turkey	US\$ 22 Billion	Under Development
Case (5)	Belo Monte Dam	Brazil	US\$ 18.5 Billion	Under Development
Case (6)	Tarbela Dam	Pakistan	US\$ 1.5 Million	Developed
Case (7)	Cahora Bassa Dam	Mozambique	US\$ 2.2 Billion	Developed
Case (8)	Great Manmade River	Libya	US\$ 25 Billion	Likely cancelled due to political instability and overthrow of the regime that sponsored it
Planned Cities and Urban Renewable Projects				
Case (9)	Egypt Space Programmes	Egypt	US\$ 21 Million	Halted
Case (10)	The Western Desert New Axis	Egypt	Not Available	Halted
Case (11)	2010 FIFA World Cup Stadia	South Africa	US\$ 2 Billion	Developed
Case (12)	Nelson Mandela Bay Metropole	South Africa	Not Available	Under Development
Case (13)	Historical Sites	Ethiopia	Not Available	Halted
Case (14)	Lakhta Centre	Russia	US\$ 2.56 Billion	Under Development
Case (15)	400 Housing Projects	United Arab Emirates	US\$ 4.4 Billion	Developed
Bridge and Highway Projects				
Case (16)	Suramadu Bridge	Indonesia	US\$ 445 Million	Developed
Case (17)	Egypt - Saudi Arabia Bridge	Egypt & Saudi Arabia	US\$ 4 Billion	Cancelled
Case (18)	Rusky Bridge	Russia	US\$ 1 Billion	Developed
Case (19)	Baluarte Bridge	Mexico	US\$ 118 Million	Developed
Case (20)	Bandra–Worli Sea Link	India	US\$ 16 Billion	Developed
Case (21)	Hangzhou Bay Bridge	China	US\$ 1.42 Billion	Developed
Case (22)	Lahore Ring Road	Pakistan	US\$ 11 Billion	Developed
Rail and Rapid Transit Projects				
Case (23)	Beijing Subway	China	Not Available	Developed
Case (24)	Bucharest Metro	Romania	US\$ 954 Million	Developed
Case (25)	Cairo Metro (Phase 1)	Egypt	US\$ 62 Million	Developed
Case (26)	Greater Kuala Lumpur Mass Rapid Transit	Malaysia	Not Available	Launched on 2011
Case (27)	Tehran Metro	Iran	US\$ 18 Billion	Developed

Airport Projects				
Case (28)	2nd Bangkok International Airport	Thailand	US\$ 4 Billion	Developed
Case (29)	Kuala Lumpur International Airport	Malaysia	US\$ 3.5 Billion	Developed
Case (30)	Guangzhou Baiyun International Airport	China	US\$ 3 Billion	Developed
Case (31)	Kuala Namu International Airport	Indonesia	US\$ 2.54 Trillion	Under Development
Case (32)	Bandung Majalengka International Airport	Indonesia	US\$ 900 Million	Under Development
Case (33)	King Shaka International Airport	South -Africa	US\$ 900 Million	Developed
Case (34)	Long Thanh International Airport	Vietnam	US\$ 10 Billion	Under Development
Case (35)	Indira Gandhi International Airport	India	US\$ 3 Billion	Developed
Case (36)	Clark International Airport	Philippines	US\$ 1.2 Billion	Developed

Appendix (A)

Table (5) Classification Categories of (MCPs) in Developing Countries

(MCPs) Challenges		Engineering Challenges		Human Development Challenges	Managerial and Political Challenges		Sustainability Challenges		
		Design	Technical		Managerial	Political	Environmental	Social	Economical
1	Lack of design knowledge and experience related to (MCPs)	X							
2	Lack of professional expertise and full consideration of technical requirements		X						
3	Misunderstanding and partial achievement of project objectives	X			X				
4	Lack of financial resources and venture capital				X				X
5	Lack of research capacity and business innovation		X		X				
6	Missing Intermediary bodies				X			X	
7	Unfavourable regulatory framework				X				
8	Lack of providing and managing high-qualified human resources			X					
9	Bureaucracy and Corruption practices				X	X			
10	Lack of political support					X			
11	Difficulty resourcing the right skills and matching with project demands and geography			X					
12	Lack of experienced staff to accept critical roles which they are not prepared for			X	X				

13	Governance decisions fail to strike a balance between short- and long-term objectives and effective risk mitigation				X			
14	Improper identification and engagement of various stakeholder groups in the early project phases				X		X	
15	Tight service market and lack of internal capacity			X	X			
16	Improper implementation of project management processes and training of key project staff				X			
17	Lack of available on-site skilled workers or local labour forces.			X				
18	Lack of properly trained on-site supervisors			X	X		X	
19	Huge numbers of people and organisations of different specialties involved in mega projects development				X		X	
20	Ill-defined rules and procedures as well as inappropriate use of prior experience to review contingencies		X		X			
21	Inadequate communication at all levels and poor coordination interface management between project stakeholders				X		X	
22	Lack of quality front-end planning		X		X			
23	Improper decision making and overlooking specialists and stakeholders consultation during the decision making process	X	X		X			
24	Lack of construction material availability	X	X		X			
25	Ignorance of health and safety considerations as well as the absence of activating health and safety acts				X		X	
26	Weak governance of project management				X			
27	Political imperatives and authority misuse				X	X		
28	Lack of exploiting uncertainties				X			
29	Project authorisation pressures on individuals				X			
30	Failure to invest sufficiently before the project's main authorisation point				X			X
31	Unachievable targets cause sub-optimal project outcomes				X			
32	Lack of efficiency and effectiveness of the Project Management process				X			
33	Naïve risk analysis and inappropriate identification of the project consequences				X	X		X
34	Inappropriate behaviour of the client organisation				X	X		
35	Lack of considering environmental requirements and preserving historical sites and natural reserve				X		X	

36	Ineffective project management and poor use of experience and competency of client and contractor organisations	X	X		X			
37	Lack in managing complexities of work content and work processes		X		X			
38	Lack of strategic project planning and ineffective leadership		X		X			
39	Leadership problems				X			
40	Lack of managing social project complexity						X	
41	Lack of managing cultural project complexity						X	
42	Inappropriate level of scientific and technological knowledge and application required	X	X		X			
43	Lack of providing quality education and professional training programmes			X	X			
44	Political tension between countries				X			
45	Stakeholders change project requirements at later stages of the project life cycle	X	X		X			

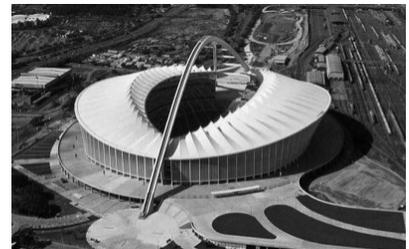
Appendix (B)



Toshka Project, Egypt



Kuala Lumpur International Airport (KLIA) Project, Malaysia



2010 FIFA World Cup Stadium in Durban, South Africa



Second Bangkok International Airport, Thailand



Suramadu Bridge, Indonesia