



CENTRE OF EXCELLENCE
China-Pakistan Economic Corridor

**PROSPECTS OF BUSINESS INFORMATION
MODELING (BIM) IN SUPPORT TO CPEC**

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ABSTRACT

This paper sheds light on the methodology of “Business Information Modeling (BIM)” and the benefits associated with it. It further represents the case studies regarding the usefulness of BIM in countries namely: UAE, Singapore, Dubai and Spain. This paper indicates the diversity and complexity associated with the gigantic portfolio of China Pakistan Economic Corridor (CPEC) and its implementation. This study also examines the capabilities of BIM to address the diversity and complexity issues associated with the CPEC portfolio. Few specific recommendations are also given about the usefulness of BIM in support to the various projects/sectors of CPEC portfolio





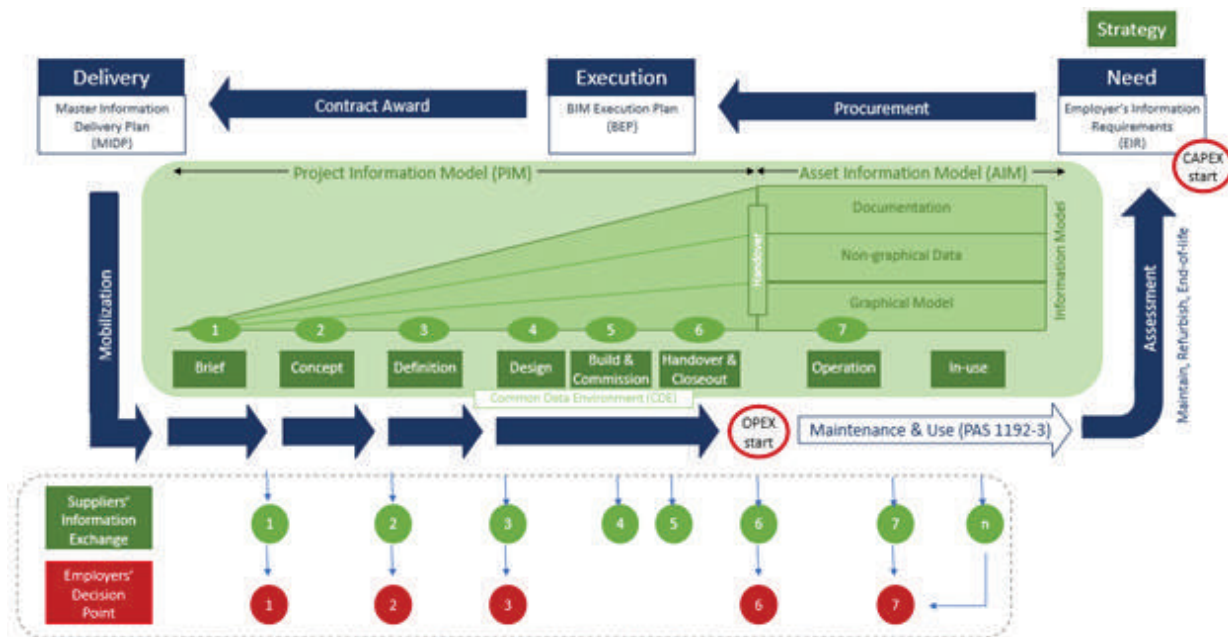
INTRODUCTION

Business Information Modeling (BIM) is the process to generate a rich information model, consisting of potentially multiple data sources, elements of which can be shared across the life of a project from inception to recycling. The BIM Protocol has been initially commissioned by the UK Government in 2011. The Protocol has been drafted to be used on all common construction contracts and supports BIM working at an advanced level. It identifies the BIM that are required to be produced by members of the Project Team and puts into place specific obligations, liabilities and associated limitations on the use of the models. This can also be used by the clients to require the adoption of a common naming standard. Moreover, primary objective of the Protocol is to enable the production of Building Information Models at defined stages of a project. The Protocol is aligned with Government BIM Strategy and incorporates provisions which support the production of deliverables for 'data drops' at defined project stages. It also provides the appointment of an 'Information Manager'. A further objective of the Protocol is that its use will support the adoption of effective collaborative working practices in Project Teams.

China Pakistan Economic Corridor (CPEC) itself is a long term mega portfolio including energy, road, rail, dry ports, optical fiber, Gwadar Port, special economic zones projects. In long term other sectors like agriculture, education, transportation and logistics, tourism and cultural exchange, financing and financial sector integration and others are included. These types of gigantic and diverse projects have never been built in the entire history of Pakistan. Besides the benefits envisaged by the CPEC projects, it owe a lot of project complexity which require advance tools to effectively support the projects. BIM can be very useful to manage the CPEC projects information efficiently and effectively for their whole life cycle. So, keeping in views the capabilities of BIM and the requirements of CPEC, this paper explores the ability of BIM to support the CPEC portfolio.

2. BIM IMPLEMENTATION

BIM is very simple to implement at each step of project life cycle as shown in below mentioned figure:



The above figure illustrates the project life cycle in a systematic way from brief to delivery the proper implementation of BIM. BIM can save the lead time and cost in terms of capital/operation expense optimally.

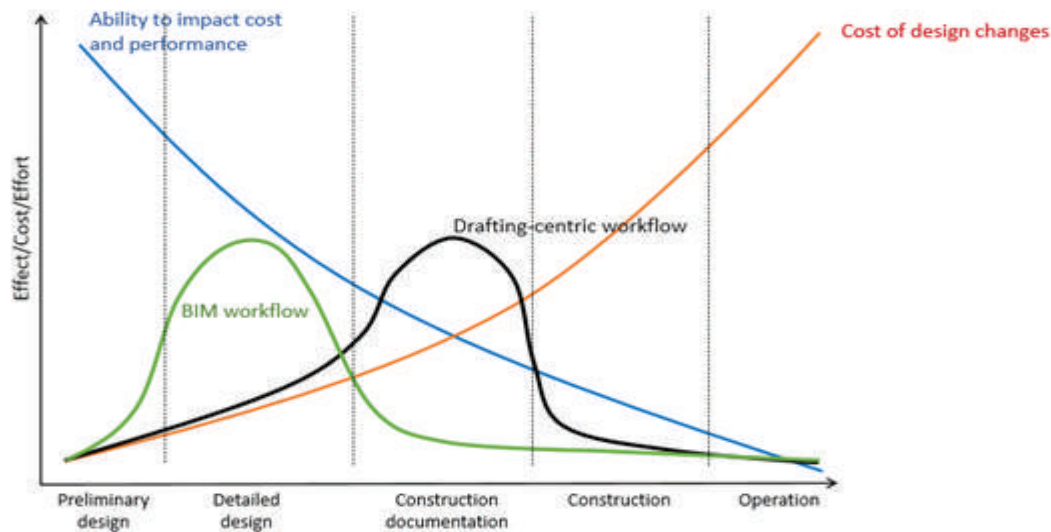
Proper application of BIM can:

- Reduce the lead time 15% and cost 10-20% of the projects
- Digitize the Documentation
- Improve the Governance and Accountability
- Secure the Information
- Reduce significantly the maintenance and cost

3. BIM BENEFITS

Benefits of BIM could be illustrated using "The Macleamy Curve" which shows how it affects the cost for the whole life cycle of project. "The Macleamy Curve" given on next page shows that with the implementation of BIM the design of the project is possible to be complete earlier and hence in the construction phase, fewer changes are expected which complete the project within due course of time and capital.

WHY BIM? "THE MACLEAMY CURVE"



This graph illustrates how BIM is saving the overall cost of project in early stages of project. BIM is an important tool which can reduce the cost of design changes exponentially through proper information handling and harmonization in early phases of projects.

4. CASE STUDIES

There are several case studies regarding the designing, implementation and usefulness of BIM in different countries and their various sectors. Following are few of these examples related to the scope of this paper.

Western Countries using BIM

- United States
- United Kingdom
- Scandinavia
- Germany
- France, and others

Asian Countries using BIM

- Singapore
- China
- South Korea
- UAE, and others

4.1 BIM IN SINGAPORE

Building & Construction Authority (BCA) targets the construction industry to use BIM widely by 2015. BIM implementation is divided into different categories; 1) Strategy 2) Remove impediments 3) Incentivize early adopters 4) Create the demand by the public sector taking the lead 4) Build BIM capability and capacity 5) Promote success stories. In September 2010, BCA established the Centre of Construction IT (CCIT) to guide professionals and companies from the construction industry in their BIM journey. Targets for BIM execution: 2013 - mandatory architecture e-submissions for all new building projects >20,000 m², 2014 - mandatory engineering e-submissions for all new building projects >20,000 m², 2015 - mandatory architecture and engineering e-submissions for all new buildings projects >20,000 m².

4.2 BIM IN SPAIN

A strategy to introduce mandatory BIM working in public sector projects was launched in Spain in July 2016. This marks a step-change in Spain's approach to BIM, where before July 2016, BIM use has been patchy, with just a few enlightened regional governments acting as beacons and far-sighted companies leading adoption.

The strategy was announced at a meeting convened by the Ministry of Public Works (Ministerio de Fomento), where the minister, Ana Pastor, emphasized that the switch to BIM working would represent both a cultural shock and an opportunity for the industry.

A steering committee - Comisión para la implantación de la metodología BIM has been set up to promote the implementation of BIM in the Spanish construction sector, life-cycle use of BIM and the development of national standards to facilitate BIM practices. A provisional timetable has been set, with recommended use of BIM in public sector projects by March 2018, mandatory use in public construction projects by December 2018 and mandatory use in infrastructure projects by July 2019.

4.3 BIM IN UAE

There is a feeling in Dubai that after years of fairly Tax regulation on project management – which had undoubtedly resulted in many substandard projects, not to mention delays and budget overspends – the use of BIM can only serve to benefit Dubai's construction industry.

"The main BIM advantage is resolving design clashes between different disciplines – mechanical, electrical, civil – resulting in major savings in time and redundancies," said Khaled Awad, the founder of Greenea and a consultant on the initial designs for Masdar HQ, in which he said that BIM was "indispensable".

"BIM is critical in complex structures and without such projects would incur sizable losses in time and money," Awad said.

4.4 BIM IN DUBAI

The Dubai regulations will only apply to buildings over 40 stories or more than 300,000 ft², as well as government projects including hospitals, universities and schools. Its focus on big projects reflects the fact that BIM helps to streamline complex developments that utilise a range of stakeholders.

Top Global Companies using BIM

- **Turner Corp. (\$ 5.4 B)**
- **URS Corp. (\$ 4.1 B)**
- **Hensel Phelps (\$ 2.2 B)**
- **Mortenson (\$ 2.2 B)**

5. BIM CAPABILITIES

BIM is used in several ways, including but not limited to the following in many developed countries.

- Building Maintenance Scheduling
- Building System Analysis (operational)
- Asset Management
- Space Planning & Tracking
- Disaster Planning
- Record Modeling
- Existing Conditions Modeling
- Engineering Analysis
- Energy Analysis
- Structural Analysis
- Lighting Analysis
- Mechanical Analysis
- Other Engineering Analysis, Sustainability (BREEAM) Evaluation
- Building Code Validation
- Programming
- Cost Estimation
- Digital Fabrication
- 3D Control & Planning (Digital Layouts)
- Visualization
- Design Authoring
- Design Reviews
- Phase Planning (4D Modeling)
- 3D Coordination
- Site Utilization Planning
- Site Analysis
- Construction Systems Design (Virtual Mock-up)

6. BIM IN SUPPORT TO CPEC PORTFOLIO

Three things are very important to handle CPEC related mega projects properly; 1) Documentation based on financial, initial plans, work in progress, current status, usage 2) Proper Governance 3) Information Security. Keeping in view the aforementioned capabilities and benefits of BIM, It can be adopted in CPEC portfolio for efficient and effective management of its diverse and complex projects.

6.1. BIM IN ENERGY PROJECTS

75 percent of current short term CPEC portfolio is based on energy projects amounting USD 33 Billion. And this energy portfolio is very diverse in terms of energy mix, financing/capital methods, regulatory regimes, tariff determination, profit sharing, operations and maintenance. So it can be very complicated to manage all these things of 19 energy projects under CPEC. Keeping in view the strengths of BIM, it can be very useful to manage these projects effectively and efficiently.

6.2. BIM IN ROAD, RAIL AND ICT

Currently around USD 12 Billion is allocated to road, rail and ICT projects under CPEC and it has always been difficult to make financial closing (FC) of all mega infrastructure projects but with the capabilities of BIM it is convenient and efficient to make precise budgets for these infra projects.

6.3. BIM IN GWADER PROJECTS

Around USD 14 Billion is allocated to Gwadar Port and Gwadar Port Smart City. The case studies of Singapore, UAE/Dubai shows that BIM support the projects include port based projects. So, BIM can also be used in Gwadar projects to bring these at par with the international standards.

6.4. BIM IN SPECIAL ECONOMIC ZONES (SEZ)

This CPEC SEZs are under feasibility and development and are considered as the important growth centres for Pakistan. So, it is a dire need to establish these zones through proper planning and BIM can be very useful tool to the sustainable development of SEZs. Local companies and business can adopt BIM for improving their Corporate Governance and automating it to be able to compete under CPEC umbrella.

Specific Benefits of BIM for CPEC

- **Cost savings and financial planning**
- **Time savings**
- **Transfer of technology**
- **Training of engineers**
- **Lower cost of maintenance**
- **Standardization across projects**
- **Better project management**
- **Better overall management of CPEC**

Benefits of BIM to different role holders of CPEC

- **Regulator**
- **Project Owner**
- **Contractor**
- **Sub – Contractors**
- **Hardware Vendors**
- **Architects**
- **Project managers**
- **Contractors for international markets**

7. RECOMMENDATIONS

BIM is a paradigm internationally adopted at the enterprise level and Government level. For Instance developed countries like UK, Spain, and Singapore are using it in all projects and saving CAPEX/OPEX and time up to 20% and 15% respectively.

BIM in support to CPEC

- BIM supports all projects under inception/feasibility stage
- BIM could be used for Energy, Road, Rail, ICT, Gwadar Port, Gwadar Port City, SEZs, and other projects of CPEC
- Proper application of BIM will reduce; Lead time up to 15%, Cost up to 20%, and significantly improve the repair & maintenance activities for the CPEC projects given above
- BIM implementation cost in most of the cases is far less than the savings it imparts.

There is a great potential for BIM to be used for the CPEC Portfolio. BIM can conveniently be used for CPEC projects because of its usefulness. For instance, priorities SEZs of CPEC are in the feasibility phase and hence can include a BIM Module for the development and management of SEZ. Other projects like Infra and Energy which are under feasibility can also use BIM. Proper application of BIM reduces; lead time 15% and cost 10-20%. BIM is a comprehensive project management methodology; hence BIM can be used in all CPEC projects including energy, infra, ICT, Gwadar, and SEZs etc. to make them optimal and sustainable.

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