

Development Model for Commercial Office Real Estate in Thailand's Green Market

by

Peerati Upatising

Bachelor of Architecture, 2012

Syracuse University

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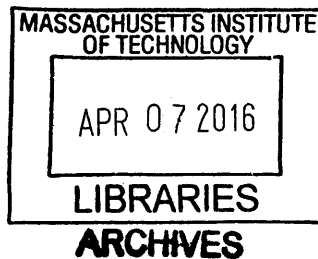
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Signature redacted
Signature of Author _____
Center for Real Estate
January 8, 2016

Signature redacted
Certified by _____
Dr. Andreea Chegut
Postdoctoral Research Associate, Center for Real Estate
Thesis Supervisor

Signature redacted
Accepted by _____
Professor Albert Saiž
Daniel Rose Associate Professor of Urban Economics and Real
Estate, Department of Urban Studies and Center for Real Estate



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ABSTRACT

In recent years, global interest in the effects of climate change have increased dramatically. Private industries are becoming aware of the needs to address environmental impacts of development. Thailand's commercial real estate industry has been under little pressure despite being responsible for over 40% of all the energy consumption in Thailand. The real estate industry is in a distinct position to address the issue of energy consumption and the barriers to green building adoption.

As part of the corporations' marketing strategy, green certification is a branding approach that limits the environmental impact of real estate development. By conforming to the LEED criteria, the green certified building introduces a new office product and building management paradigm to mainstream commercial real estate development. However, the barriers to green buildings continue to exist, including the ability to deliver green projects within appropriate cost expectations. Modifications must be made to traditional project management practices for project managers to deliver green construction projects. The objective of this paper is to recommend specific modifications to traditional building practices in Thailand with the goal of optimizing the delivery of cost-efficient green office buildings. Through the analysis of five LEED certified offices, this thesis explores the innovation sources, delivery methods, contractual forms, and risk allocation in implementing of Grade A green office buildings.

The thesis finds that the private sector plays a crucial role in advancing green development practices. Project success motivates the government to encourage innovation through regulation and training. The projects that illustrate the most innovative method comprise of small and multi-disciplinary development team structures with a heavyweight project manager. An examination of the implementation process of green certified office buildings reveals that much of the anticipated risks related to innovation's stage of green adoption is related to educational gaps in the industry. Specific provisions which include incentive and penalty systems designed for constant adjustments help to mitigate risks and regulate relationship between developers and consultants. In implementing green construction practices, design phase could also incorporate environmental analysis by an in-house team with energy and sustainability backgrounds who inspire collaboration of generalists and a specialized workforce.

Thesis Supervisor: Andrea Chegut

Title: Postdoctoral Research Associate of Center for Real Estate

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Part I

Chapter One

1.0 Sustainability and AEC Business Platform

As the emerging ASEAN markets continue to grow rapidly, there is considerable interest in sustainability in the real estate industry to all level of participants, including government, developers, investors, tenants, and the community. Climate change has stimulated many actions exponentially with the unified goal to battle the adverse effect and global impacts of climate change itself. Because of rapid urban expansion, and robust economic growth in the ASEAN's emerging markets, the Southeast Asian nations have experienced a soaring energy demand from the real estate industry.¹ Compared to other sectors, the commercial real estate sector has the highest energy share, rising to approximately 40% since 1990 in Thailand. According to the Thailand Ministry of Energy, the sector's energy consumption considerably surpassed the economic growth from historical energy and statistical data. By 2010, the economic growth more than doubled, while the energy demand in commercial and industrial sectors more than tripled.

In recent years, green building has become a long-term business opportunity with strong expected growth in the global real estate market. International firms are anticipating that more than 60% of their projects will be green. In Singapore, 69% of high-rise residential, and renovation projects planned are green certified.² Thailand's green building market grew by 33%, totaling \$3 Billion USD. Additionally, market demand for energy efficient building has become the main driving force for private companies to invest in green certified developments. This is done not only from an idealistic desire to have a positive impact on the climate change, but also from the marketing position, which aims to improve the multinational corporates' branding within the ASEAN Economic Community (AEC). Subsequently, green certificates are becoming a crucial marketing tool for the commercial real estate developers as the international and local markets increasingly see the need to incorporate sustainability strategies into their business platforms.

As the AEC comes into effect in 2015, Thailand is among the best locations for multinational firms to expand their investments within the ASEAN markets. Green offices are the first choice for most seeking headquarters in the region. Thus, the demand for green offices has been increasing exponentially in Thailand since 2007. Many global corporations, such as Johnson & Johnson, Toyota, Shell, and HSBC are setting up regional operations, and are using green facilities as part of their corporate social

¹ "20-Year Energy Efficiency Action Plan (2011-2030)". Energy Policy and Planning Office (EPPO). Ministry of Energy. 2011

² "Thailand's Green Buildings Goals Aspirations & Realities". Solidiance. 2014

responsibility commitment to boost their corporate image and improve employees' productivity.³ Because of high market demand, the commercial segment is now the biggest adopter for developing green building in Thailand.⁴ For financial sectors, innovative commercial office products also provide monetary rewards to investors. As commercial real estate is both a hedging instrument for inflation risk, and a diversification strategy for financial portfolios, commercial office products become a critical capital input for the economic production at large. Kasikorn Bank, and Univentures PLC are prime examples of Thai public companies investing in energy conservation through developing prominent LEED certified office buildings as a marketing strategy to increase share values.⁵

1.1 Sustainability Policies and Initiatives

In the US, almost 40% of overall energy are consumed by residential, and commercial sectors. The largest portion are spent through building structures, while the transportation sector is only responsible for 29%. Buildings also consume between 60-65% of annual electricity.⁶ This trend remains equivalent to that of other countries. In Thailand, residential sectors consume up to 37% of annual electricity.⁷ A large sum of energy consumption in buildings has put real estate industry in a vulnerable position of being targeted for energy consumption reduction policies. Conversely, the real estate industry is in the distinctive position of being able to reduce energy consumption through energy efficiency improvements that are low cost, and can create value within the underlying property asset.

In Thailand, there is substantial policy interests in setting limits and standards on sustainability criteria at the government level to address issues surrounding climate change. The environmental sustainability are gaining momentum in real estate industry because of increasing social demands. Thai Energy Policy and Planning Office (EPPO) which is the central agency that sets and manages national energy policies, also has established regulatory frameworks to provide incentives for developers to build green. As part of Thai-German energy efficiency plan, Thailand government also created an Energy Efficiency Development Plan in 2011 with the goal of reducing energy intensity by 25% by 2030. The strategy is implemented to integrate baseline and energy data management, energy efficiency standards, and incentive instruments with climate change policy. The new city planning code in Bangkok Metropolitan Area (BMA) stipulated that the development FAR can be increased up to 20% for projects that are green

³ "Demand of Tenants for Grade A and Green Office Buildings: Sample Group from Office Buildings of Government Pension Fund". Chulalongkorn University. 2009.

⁴ Ibid.

⁵ Green Building Consultant. Interview by Author. August 2015.

⁶ "Towards a climate-friendly built environment Brown." VA: Pew Center on Global Climate Change, 2005.

⁷ "20-Year Energy Efficiency Action Plan (2011-2030)". Energy Policy and Planning Office (EPPO). Ministry of Energy. 2011

certified.⁸ The buildable area can also be increased by 5% if the building can address rainwater retention issue by providing at least one cubic meter of rain capacity per 50 square meters of built area. Similarly, there are tax incentives that give green developers to receive tax deduction with the goal of attracting international companies to set up their headquarters in Bangkok. For instance, a 10-year, 10% fixed income tax rate, which is a steep discount from the conventional 30%. Moreover, the Thai government has approved 350 energy efficiency projects for their five year, 25% corporate tax credit, which back investment up to a 1.25 million US dollars. Similarly, 100% of energy saving can be used for tax exemption with maximum support of 56,000 USD for demonstrating proven energy conservation not less than 3000 USD per year.⁹ However, the discontinuity of policies have made it challenging for developers to be confident in the Thai government. The 2.2 billion of certified commercial LEED projects have the potential to obtain almost 4 billion US dollars EAct tax deductions.¹⁰ To further incentivize green developments in the private sector, Thailand's Energy Efficiency Revolving fund was established in 2003 by the Department of Alternative Energy Development and Efficiency to provide a line of credit to local banks, and low-interest loans to developers for developing energy-efficient products. For example, the loan periods is up to 7 years with a maximum allowable interest rate of 4%. Furthermore, Kasikorn Bank also offer a lower interest rate for businesses specialized in energy efficiency and renewable energy, for a period of up to seven years.¹¹

1.2 CSR: The Relevance of Energy-Efficient Buildings to Business Strategies

Meanwhile, the investments in Corporate Social Responsibility (CSR) have become an essential part of mainstream investment practices. CSR is integrated into three main categories: social, environmental, and governance issues. The catalysts at local and global levels include the Kyoto Protocol, UN Principles of Responsible Investment, the UN Environment Program Finance Initiative, Global Report Initiative, and Institutional Investors Group on Climate Change (IIGCC).

For many investors, evaluations of social responsibility have become a criterion. Although, many have yet to determine the economic rationale for investing in companies that rank high in CSR performance, approximately \$2.7 trillion USD is current allocated to the socially screened portfolios in the US.¹² Large

⁸ "Thai's Rating of Energy and Environmental Sustainability for New Construction and Major Renovation for Core and Shell Building." Thai Green Building Institute (TGBI). 2014

⁹ "Thailand: Setting the standard in green building incentives" Oxford Business Group. Accessed online 2015. <<http://www.oxfordbusinessgroup.com/news/thailand-setting-standard-green-building-incentives>>

¹⁰ "Summary of Government LEED Incentives" USGBC. Accessed online 2009. <http://bomali.org/LEEDbldgtaxopps_01-08.pdf>

¹¹ "Financial Support Programmes for Energy Efficiency in Thailand" German-Thai Chamber of Commerce. Accessed online 2015. <http://www.thai-german-cooperation.info/download/20130616_09_pdp_ee_building.pdf>

¹² "Doing Well by Doing Good? Green Office Bulidings". The American Economic Review. 2010.

capitalized multinational corporations (MNCs) such as Siam Cement Group (SCG), PTT, Toyota, and SMEs business group usually have well-defined CSR policies that aim to promote environmental impact reduction policies by building windmills, recycling cement bags, organizing activities to raise awareness for energy conservation. Another example is Toyota who sets up competitions among the regional dealers to encourage CSR activities.¹³ Firms with well-established CSR programs are potentially able to outperform others for many reasons, such as improved corporate reputation, improved profitability through lower input costs, and higher employees' productivity.¹⁴ Several governmental and public organizations such as Department of Industrial Work, Ministry of Industry, Institute of SME, Thai Health Promotion Foundation, and Petroleum of Thailand, have envisioned CSR as part of their three pillars of sustainable growth strategies. SCG and PTT have located at least 10% of their revenue to CSR. As a result, many green headquarters and green grade-A office buildings have been developed in the ASEAN.

Investment in office buildings that incorporate enhanced standard of green can lead to economic and business benefits in many distinct ways, such as budgeting decisions. With the supports from tenant and real estate investor demand, such as Lend Lease, and British Land, CSR has been reinforced by the global establishment of Green Building Councils. CSR also has been promoted as part of the main branding strategy within the last 20 years. Recent research on CSR momentum conducted on Southeast Asian countries has been primarily focused on rent premiums in green buildings, CSR drivers, social performance, and corporate governance. In sum, there is an overall strong commitment to CSR, which can be empirically matched by investment performance.¹⁵

Leasing an energy-efficient space sends a strong positive signal for social responsibility from the developers and occupants. As a result, the corporate reputation is enhanced, enabling firms to charge higher rent prices, and investors' returns are maximized. Also, tenants may be inclined to pay higher rents as a means to save operating costs, improve employees' productivity, and improve corporate brand.¹⁶ More importantly, there is international statistical data that shows that in developed countries, green buildings can command higher rents and sale prices.¹⁷

¹³ Managing Director of Toyota Thailand Regional Dealer, interview by author, August 2015.

¹⁴ "Demand of Tenants for Grade A and Green Office Buildings: Sample Group from Office Buildings of Government Pension Fund". Chulalongkorn University. 2009.

¹⁵ "Assessing the Linkages Between Corporate Social Responsibility and A-REIT Performance". Pacific Rim Property Research Journal, Vol 17, No 3, 2011., p. 370-387.

¹⁶ "Demand of Tenants for Grade A and Green Office Buildings: Sample Group from Office Buildings of Government Pension Fund". Chulalongkorn University. 2009.

¹⁷ "Doing Well by Doing Good? Green Office Buildings". The American Economic Review. 2010.

1.3 Green Building Development in Thailand

Although green certified office development has become a standard in many cities in the US, it is still a new and vulnerable concept in Thailand. Thai developers often face financial dilemma to overcome barriers, such as increased development costs from uncertainty in building green. A recent study on the price of innovation and the marginal cost of green building suggests that the overall cost of green buildings have 65% higher design costs as compared to conventional buildings.¹⁸ The higher design costs could reduce the developers' incentive to build green offices because the increased fees impose significant risks to developers. Although the design fees are less than three percent of overall construction costs, they are costs that the developers need to pay upfront, during which the developers also face extreme uncertainty over land and building permits. Additionally, green certified buildings usually take 30% longer to finish construction.¹⁹ Furthermore, the case study analysis in this thesis illustrates that the main reasons to an unpredictable and longer green development timeline come from lack of locally sourced construction materials, and a skilled workforce. Consequently, green buildings expose developers to significant risk as the developers have to wait longer to recover their initial capital investments.

These barriers to green building continue to exist. The case study analysis further illustrates that developers still apply conventional construction management practices in green developments, often resulting in many field adjustments, delays, and increased construction and operation costs. Delivering a cost-effective green building thus requires modifications to the conventional project management methodology. To minimize the developers' exposure to risks that were created from poor timing decisions in traditional construction management, existing green building practices are thus carefully examined. The thesis concludes with the most vital modifications to project management practices necessary for delivering a cost-efficient green office building by integrating the analysis of the associated risks of building green. In this way, project managers and developers can modify the processes of the green project execution to mitigate risks.

The goal of this research is in two-fold: First to examine the delivery methods, contractual forms, and risk allocation in the existing green project developments in Thailand, and second to propose the crucial modifications to the green construction management practices as a way of mitigating risks and fostering innovation in the green market.

¹⁸ "The Price of Innovation: An Analysis of the Marginal Cost of Green" October 2015. p. 25

¹⁹ Ibid.

Firstly, the structured interviews are designed to identify the organizational architecture of the project's team, project delivery methods, and contract type for every phase. The case study analysis in this thesis aims to identify crucial factors in successful green construction, and set a clear framework for building cost-efficient green office buildings in Thailand. To do this, the sources of green certification, organizational structures, development processes, and delivery methods in commercial office buildings are explored. By shifting project delivery methods and contracts, various development stakeholders can minimize risks and maximize incentives among the parties in green development.

Secondly, this thesis is developed base on the assumption that product innovation, such as green certified offices, may require different project delivery methods and processes of project execution. Product innovation represents unique and improved goods and services, which may mandate changes in the organization of companies to facilitate innovation.²⁰ Specific modifications to conventional office building delivery practices are proposed to all project participants according to stages, phases, and activities in order to optimize the delivery of cost-efficient green buildings. By doing so, the degree of discrepancies between the ideal forms of green development and existing conventional construction can be decreased.

The thesis lays out a decision-making framework for developers, designers, construction professionals, and policy makers. Corporate sector may understand more clearly, the investment implications for delivering building designs with the goal of encouraging green label adoption in Thailand. Seeking to comprehend the role of an organizational structure, project delivery methods, and contracts in green certified development, the thesis asks the following questions to establish framework for interview questions which are further discussed in Chapter Five:

- *Where does the green certification in mainstream commercial real estate stem from? How does the sector pick up the innovation? Is it mainly driven by the market or the government?* The thesis examines the development experiences from idea conception to stabilization of office projects in Bangkok to understand factors that motivates the development teams to build green certified offices.
- *Because of the uncertainty introduced by a new and unknown product in the commercial office industry, developing to green assessment standard will introduce inherent risk to a project. Therefore, with the increase in inherent risk, who are the ones that bear the risk of integrating*

²⁰ "Innovation: A Guide to the Literature". The Oxford Handbook of Innovation eds. 4. 2005

green assessment standards into the development process? A thorough examination on the contracts and project delivery methods of the case studies allow for a better understanding on the responsibility distribution across the development horizon, and the risk and reward of green office development projects.

- *Does developing to the green rating systems introduce new risks, or increase the existing risks of the traditional development process? And who assumes the risk of such innovation in each team?* Design, manage, and construct to certification criteria inherently introduce risk to a project because of the uncertainty created by a new and unknown product in Thai's green market.
- *What are the possible approaches for commercial real estate in Bangkok Metropolitan Area that could be adopted to increase management efficiency in every development phases?* Here, the thesis imitates the organizational structure of each development team, and the extent to which each structure types were able to foster green development.

To answer the discussed questions above, the research for this thesis relies on a case study model. The information and observations come largely from structured interviews with developers, green industry specialists, engineers, designers, energy consultant firms, and contractors who are responsible in the project or are relevant to the green market in Thailand. Existing literature and research are examined to develop comprehensive tools for understanding green assessment standards and thus develop a successful green commercial office development. Within each case study, there are insights from the developer teams, project managers, energy consultants, designers, and contractors. The wide range of interviews allow the thesis to obtain an overarching survey of the green construction industry and comprehend the motivation of energy-efficient innovation in Thailand's green market, and the types and distribution of risks that green labels introduce to the development process.

To determine the most vital modifications to the project management practices, five prominent green building case studies in Thailand are presented. The case studies are chosen because of their strong commitment to social responsibility and environmentally sensitive commercial developments. Since large development projects are generally market driven projects, there is a significant foundation to begin deriving current insights to address risk and concluding optimal manner. The five case studies, as shown in *Table 1*, are analyzed to focus on product innovation of green office buildings in Thailand, with platinum being the most innovative as developers are subjected to extensive criteria. One of the common goals that the following projects share is to attract foreign investors after AEC commencement by

offering the premium leasable structure which provides ample and energy-efficient office spaces. TREES certification is not selected because of less popularity in the commercial real estate industry.

Table 1: Case Study Characteristics

Type	Institutional		Corporate Headquarters			
Case Study	Energy Complex (ENCO)	Park Venture	SCG 1,2, 5	SCG 100 th Year Building	Ritta Headquarter	
Holding Company	PTT Plc., PTTEP	Univenture Plc.	Siam Cement Plc.	Siam Cement Plc.	Ritta Co., Ltd.	
Location	Bangkok, non-CBD	Bangkok, CBD	Bangkok, non-CBD	Bangkok, non-CBD	Bangkok, non-CBD	
Green Level Achieved	Platinum, 42/62	Platinum, 81/110	Platinum, 84-85/110	Platinum, 85/110	Gold, 48/69	
Year completed	Q4 2009	September 2011	September 2012	July 2013	June, 2010	
Building Use	Office, Retail	Office, Retail	Office	Office	Office	
Rental Period	3 years	3 years	-	-	-	
Land Area	11.46 acres	2.6 acres	4.7 acres		5.37 acres	
Total Gross Area	304,000 sq.m	81400 sq.m	18,900 sq.m	74,605 sq.m	10,584 sq.m	
Gross Leasable Area	137,161 sq.m	27,000 sq.m	-	-	-	
Retail	8000 sq.m	1,000 sq.m	-	-	-	
No. of Storeys	Up to 36	34	Up to 12	22	4	
Typical Floor Plate (sq.m)	1,775 – 3300	1,900-2,000	940-1,185	1,650-2,000	7,176	
Construction Value	233 M. USD	212 M. USD	3M. USD	64M. USD	11M. USD	
Development Length	2004-2009	2007-2011	2009-2012	2010-2013	2005- 2010	
Project Delivery Method	General Contractor	General Contractor	General Contractor	Construction Management	Multiple Prime	
Design	Selection Method	Bidding	Relationship	Relationship	Bidding	In-House
	Contract	Lump Sum	Lump Sum, time + material	Time + Material	Lump Sum	Salary
Construction	Selection Method	Bidding	Bidding	Relationship	Bidding	In-House, bidding
	Contract	Lump Sum	Lump Sum	Lump Sum	Cost Plus, Time+ material	Cost Plus

Notes: Table 1 break downs the characteristics of five office projects into two main types of commercial office: institutional, and corporate. An institutional office refers to a leasable office building which is typically LEED Core and Shell certified, while a corporate is a newly constructed or a renovated office building with LEED New Construction or LEED Existing Building: Operation and Maintenance certification. The table further breaks down the project delivery methods and the typical contract types used in design and construction phases for each case studies.

Through the case study analysis, the thesis is able to explore the similarities and differences between risk allocations in the design and construction processes, and investigate the underlying motivations of energy-efficient design and construction.

The analysis findings and proposed framework in Chapter Seven and Eight can be of immediate use for real estate developers of green buildings in two ways. Firstly, although there are several existing case studies about the performance and cost of green projects, there are no case studies about the project management process and risk allocations in Thailand. Secondly, there is limited information about the delivery methods, contracts, and risk allocation of green building. Green buildings in Thailand tend to be treated as specialized and fragmented products, which can add high price premiums when utilizing green products and services. The case study exploration indicates that through project management

modifications, there is a way to deliver a successful cost-efficient green building. Policy makers are advised to set avenues to ensure the real estate industry's participation in the growing green market. Real estate professionals are advised to gather opportunities in their existing assets, and monitor the green market closely in the following years to comprehend the risks, and captures the opportunities that green market will provide.

The remainder of the thesis is organized as follows:

Part I develops a comprehensive documentation of the relevant concepts on green assessment tool on office developments in Thailand, project delivery methods, contractual forms, and types of associated risk in green construction. The thesis addresses the overall international and local green building certification standards that are widely used in the commercial real estate industry. Additionally, economic literature on potential value, and the feasibility of green certifications are also reviewed. By doing so, the evolution of green initiatives and value creation in commercial offices are explored. Furthermore, Part I addresses the direct and indirect challenges and opportunities of real estate developers' participation in sustainability. In this part, the major issues that commercial office developers often face are explored through documenting the development and delivery processes of assigning responsibility and risk in each development phase.

Part II presents five case studies for commercial office projects: Energy Complex, Park Ventures, SCG Renovation: 1, 2, 5, SCG 100th Year Building, and Ritta Headquarter. The cases are examined through a series of interviews that goes through six major phases of the development (Idea Inception, feasibility, preconstruction, construction, stabilization and asset management) to understand green office development process with the goal of gaining insights into barriers and opportunities in green construction. Each case illustrates the importance of process and product innovation through team structure, delivery methods, and contractual forms. The case study analysis aims to identify key problems of the existing green project management, as well as to interpret motivations for of innovation and the influences of organization structure in executing green development. Lastly, Part II concludes with an overarching framework which highlights specific adjustments in traditional construction management practices for team formation and green construction management practices. The last chapter also outlines future research opportunities that have potential to generate further insights into the growing green market in Thailand.

Chapter 2

2.0 Real Estate Participation in Green Market

The most widely used green building certification system in Thailand is Leadership of Energy Efficiency Design (LEED). As of 2015, 76 projects are LEED certified, and 55 projects are LEED registered, or in progress of certification.²¹ LEED is developed by US Green Building Council (USGBC), which is a non-profit organization that provides a third party verification for the invention of green buildings. USGBC has been working with all sectors of real estate industry, such as manufactures and chemical companies. LEED rating systems have promoted the growth of energy efficient and high performance construction practice. Since its establishment in 2000, LEED has become the primary driver for green global market mainly because of its branding and business benefits. Although initiated in the US, LEED has established its presence globally providing internationally adopted design, construction, and operational guidelines for large commercial buildings in the city. LEED ratings has been growing rapidly in Asia with over 500 LEED rated projects over the past five years, while each country also has developed its own local system with the structure of LEED rating system.²²

The development of green building is promoted through LEED rating systems in which projects that utilize strategic criteria for processing better environmental and health performances are rewarded. Additionally, by awarding projects with specific LEED certified level (Silver, Gold, and Platinum), commercial developers are able to tap into green innovation, and various opportunities for financial benefits from improved efficiency and cost savings. But as the merits of green development take root in Thailand, other certification organizations are slowly emerging. Thai developers can choose other rating systems that are designed to be implemented in Thailand. The following three assessment tools set up Thai green building development standards:

1. Thailand's Energy and Environmental Assessment Method (TEEAM) which was an initiative launched by Ministry of Energy, in collaboration with Chulalongkorn University. The rating tool quickly disappeared with the shift in political regime in 2006. With Thai politic, if one administration delivers one things, but when an opposing party comes into administration, such policy will be automatically disregarded. Therefore, the remaining prominent rating systems were

²¹ See *Figure 1 and Appendix A*

²² "Is LEED leading Asia?: an analysis of global adaptation and trends". 2011 International Conference on Green Building and Sustainable Cities. ScienceDirect. December 2011.

established in private sectors, relying very little on the government's support to avoid policies discontinuity from changes in the political landscape.²³

2. Thailand Rating Energy and Environment System (TREES) was created by groups of engineers and architects, and run by Thai Green Building Institute (TGBI). TREES is the most widely used rating systems after LEED in Thailand.
3. German Standards for Green Construction Industry in Thailand was launched by Thailand Association for Sustainable Construction in collaboration with German Sustainable Business Council.

There are 59 TREES certified and registered, which is only 31% of all current green developments in Thailand. Approximately 64% of TREES certified and registered projects are Toyota showrooms.²⁴ However, compared to Singapore, the impact of green innovation is still minimal in Thailand. The high popularity of Green Mark is mainly due to its strong regulatory framework of Singapore's Urban Redevelopment Authority.²⁵

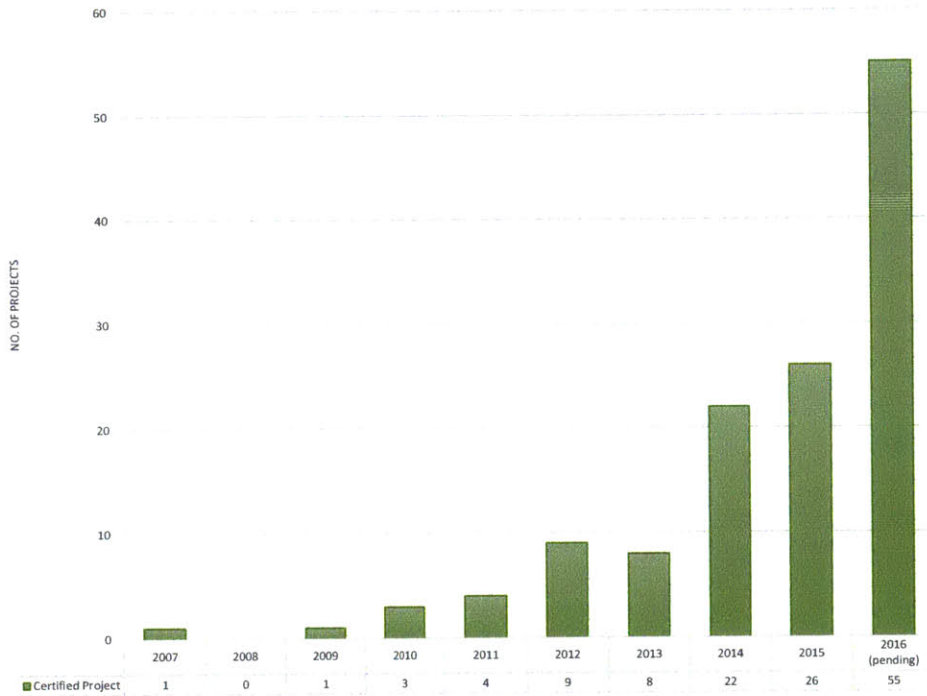
To bridge the technology and communication gap in green development, USGBC and TGBI launched accreditation programs to train and certify professionals to become familiarize with the green certification standards. LEED Accredited Professionals (LEED AP) and Green Associate (LEED GA), and TREES Accredited associate (TREE-A) illustrate the working knowledge of sustainable building practices and requirements associated with LEED and TREES certification respectively. *Figure 1*, a graph generated using USGBC's data on LEED certified buildings in Thailand, demonstrates that since 2007, the number of green buildings in Thailand has been growing rapidly, almost doubling annually. The graph shows that the number of certified buildings has increased from 1 in 2007, to 26 in 2015. This totaled to 30 certified green buildings, combining 4 TREES certified projects. This rapid growth in Thai's green market comes from an increasing awareness motivated by Thai Green Building Institute, universities, private sector, and the Thai government. *Figure 2* shows that 71% of LEED certified buildings are located in Bangkok Metropolitan Area, and 1-2% are located in other provinces.

²³ Green consultants, interview by author, August 2015.

²⁴ TREES Projects Summary Table. Thai Green Building Institute. Accessed online 25 July 2015. < <http://www.tgbi.or.th/project.php>>

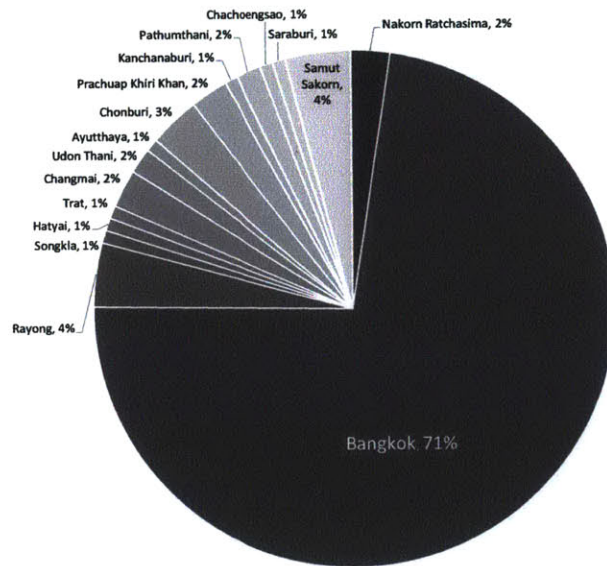
²⁵ "Is LEED leading Asia?: an analysis of global adaptation and trends". 2011 International Conference on Green Building and Sustainable Cities. ScienceDirect. December 2011.

Figure 1: LEED Adoption in Thailand



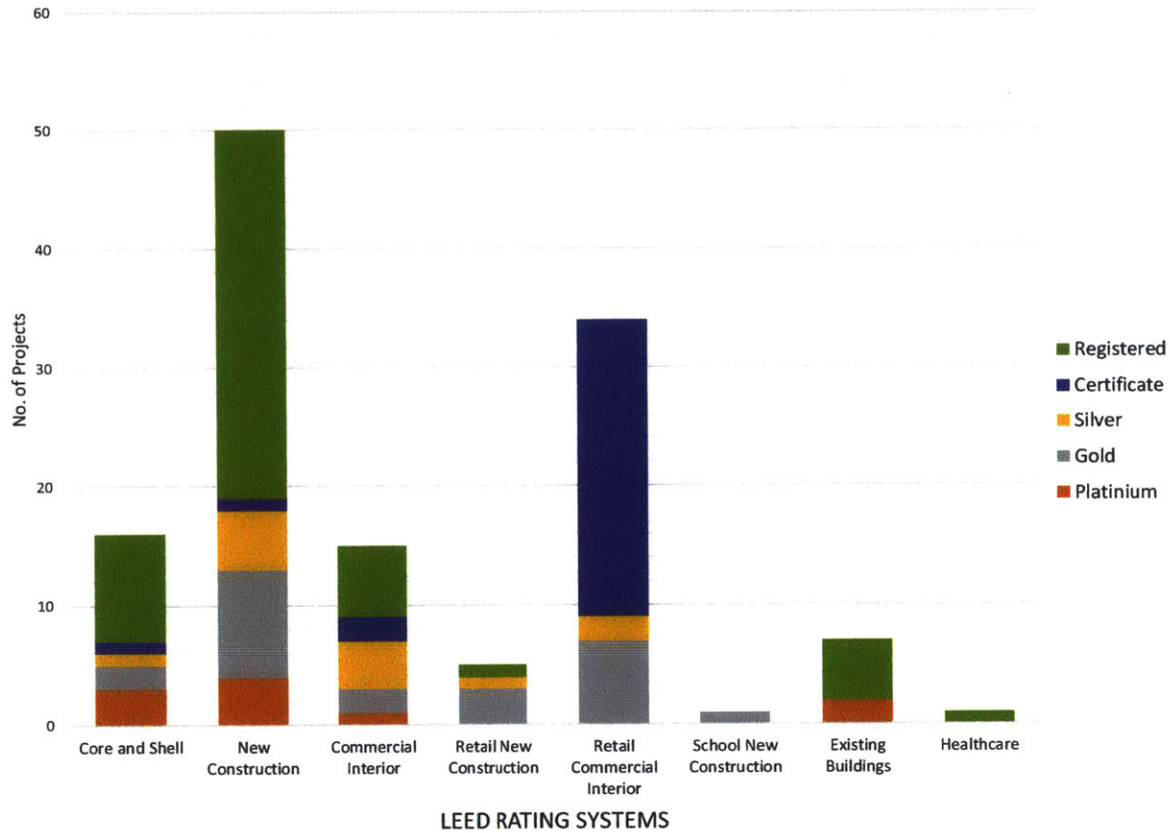
Notes: Figure 1 displays the adoption activity of commercial property in Thailand over 2007 to 2015 period. The left vertical axis is the number of LEED certified projects. The horizontal axis is the time period measure in years.

Figure 2: LEED Projects by Location



Notes: Figure 2 breaks down the geographical distribution of LEED certified commercial property as of 2015. The green building supply is built in 16 cities, 71 percent of the green certified buildings is in Bangkok.

Figure 3: LEED Rating Distribution



Notes: Figure 3 displays the distribution of LEED certification levels by the rating systems as of 2015. There are four levels of certification, each of which is determined by the number of points a project earns. Rating systems are the following: Core and Shell, New Construction, Commercial Interior, Retail New Construction, Retail Commercial Interior, School New Construction, Existing Buildings, and Healthcare. Core and Shell rating system is designed for projects where developer controls the design and construction of the mechanical, electrical, plumbing, and fire protection system. New construction rating system is designed for projects that are constructing new buildings or taken on major renovations of existing buildings. Commercial Interior rating system is designed for projects completing an interior fit-out. School New Construction rating system covers the design and construction of K-12 schools, higher education, and non-academic buildings on school campuses. Existing Building certifies the operations and maintenance of a project and create a plan for ensuring high performance over time. Healthcare rating system is used for hospitals which provide inpatient medical treatment.²⁶ As expected, there are high quantity of registered LEED projects in the pipeline.

Figure 4 categorizes green building samples by LEED rating systems using the data collected from USGBC. Here, the three most implemented rating systems are New Construction, Retail interior and Core and Shell, each of which occupy approximately 39%, 26%, and 12% of all LEED activities in Thailand respectively. LEED New Commercial Construction buildings cover approximately 40% of all type of

²⁶ "Rating System Selection Guidance" USGBC. Accessed online 2015. <www.usgbc.org/Docs/Archive/General/Docs10134.pdf>

LEED certified buildings as New Constructed Construction buildings are easier to adopt, compared to restructuring existing ones.

98% of green buildings in Thailand are commercial buildings. One of the main reasons is that residential developers are reluctant to build green certified projects. The perceived increased in rents impacts price attractiveness to the potential customers. Similarly, trivial reasons, such as tenants preferring stronger water facets, and not willing to pay more for higher efficiency and cleaner AC system may also create extra hurdles for residential developers to successfully tap into green market. However, because of Bangkok's Comprehensive Plan enacted in 2013, high-end condominium developers started to see financial benefits in certifying projects with TREES with the goal of gaining a FAR bonus.²⁷

With the upcoming AEC, setting up green headquarters in BMA to leverage the organizations' branding has caused the number of green commercial to grow exponentially. In summary, the three main drivers to green commercial buildings' rapid growth are the improved corporate image from CSR, migrating of multinational corporations, and inherent lower operating and energy costs. Therefore, an integrated polyframework and financial incentives are the necessary acts to push green construction industry forward. In this case, LEED certification offers a firm alternative for benchmarking and addressing building energy and environmental impact of the real estate industry.

2.1 Evolution of Standard Measurements and Political Timeframe

The discussion of green global trend is essential in understanding the struggle of green commercial real estate industry in Thailand in relation to other countries. In 1969, due to industrial expansion, the US government established initiatives, such as the National Environmental Policy Act (NEPA) which was developed under the Council for Environmental Quality (CEQ) Act with the goal of reducing human settlement impact on the environment and natural resources under lawful framework. In 1997, Kyoto Protocol was launched with the aim to reduce the gas emissions globally. Since 1990s, sustainable architecture has been gaining popularity, implying that the built environment is one of the sole causes of pollution. The trend of green architecture promotes low environmental impact and energy efficient in design, construction, management, maintenance, deconstruction and renovation of buildings. In 1993, USGBC was established. LEED has been adopted in over 25 countries and adapted to each countries regulations under the green building council. For example, Canada now has LEED Canada which has been operated by Canada Green Building Council, and LEED India has been managed by India Green

²⁷ "Economic Analysis of Energy Conservation Building with Floor Area Ratio Bonus". Chulalongkorn University. 2013.

Building Council established in 2011. Nonetheless, continuously updated, LEED US has been the most widely implemented globally. In 1999, World Green Building was established. Since 2002, other green certifications have been developed such as BREEAM, CASBEE, Green Mark, and HK-BEAM.

Thai green buildings and political timeframe

Because of constant political demonstrations and constitution reestablishment, the inception of green building development in Thailand has been influenced by various yet unstable legislations.²⁸ These legislations were launched in the following order to respond to the needs of reducing environmental impact, and ultimately increase the administration's popularity:

1. The Enhancement and Conservation of the National Environmental Quality Act was established in 1975 and later has been updated in 1978, 1979, 1981, and 1992.
2. The Energy Conservation Promotion Act was established in 1992.
3. In 2009, the Thai government set standards for building size, standards, and procedures in designing energy efficient building.

Environmental Impact Assessment (EIA) and Initial Environmental Examination (IEE) were established to regulate urban development and reduce environmental impact in Thailand. The key legislations have evolved as follow:

1. IEE started by regulating the construction phase of large development projects, such as dam, airport, bridges, highway, and mine.
2. In 1992, IEE also regulated the residential, condominium, hotel, resort, and hospitals development.
3. The assessment was later modified again after a coup in 1996.
4. In 1997, a small scale development, and wider coverage area such as Krabi, Phuket, Pattaya, and Chonburi were included.
5. In 2005, the Department of Alternative Energy Development under Ministry of Natural Resources and Environment has established environmental awards system to residential projects.
6. Concurrently, Thailand Energy and Environmental Assessment Method (TEEAM) was established under the Department of Alternative Energy Development and Efficiency managed by Ministry of Energy to promote green construction and energy efficient building industry.

²⁸ Green Consultants, interview by author, August 2015.

7. In 2009, the Pollution Control Department under Ministry of Natural Resources and Environment established green building assessment tools for government buildings with two main categories: Existing and New Construction Building. At the same time, TREES was established under Thai Green Building Council in the private sector using LEED as a model but based on Thai law instead of US standards.

Since then, multiple initiatives for green design awards have been developed, such as ASA Green Design Award 2010 which was formed by Thailand Green Building Institute and The Engineering Institute of Thailand. Until 2012, the Ministry of Energy's Energy Conservation Revolving Fund, in collaboration with many banks, loaned \$200M. USD to help finance about 300 green projects. As the idea of green buildings caught public attention, commercial banks such as Kasikorn Bank began issuing similar loans.

Because of the government's inconsistent supports for particular green assessment tools and support-funding for green buildings, Thailand still struggle to promote its own green buildings standards. Consequently, LEED rating systems have been widely adopted as the assessment standard.²⁹

²⁹ Green Consultants, interview by author, August 2015.

Chapter Three

3.0 Innovation Typologies in Development Process

There are two fundamental types of innovation outlined by Joseph Schumpeter in his research on innovation. The first type is product innovation which refers to new and improved goods and services. The second type is process innovation which refers to an addition of new ways to organize work.³⁰ The innovation typologies play crucial roles in understanding the process of developing green buildings in Thailand.

This thesis uses product and process innovation of green building to establish a concrete framework for the investigation with the goal of analyzing how the delivery methods, contractual forms, and risk allocation of the case studies allow for innovation in the green market. The case studies analysis is the departures of the existing conventional office building developments through designing, constructing, and renovating office buildings to LEED rating systems. Because green development is still a new practice in large scale office development in Thailand as seen by the limited number of green supplies in the past, the design and construction professionals must execute their works from a different approach. The product innovation of green buildings thus demands process innovation in order to deliver a successful cost-efficient green office. The process innovation includes a readjustment to risk allocations, and a shift in organization structure to the project management approach. These modifications to the project management of green buildings establish a concrete framework for the organizational structures that are governed by formal and informal contracts. An investigation of the organizational architecture in each case studies demonstrate whether the modifications have begun to respond to innovations in the green, and whether the shifts are appropriate for each cases.

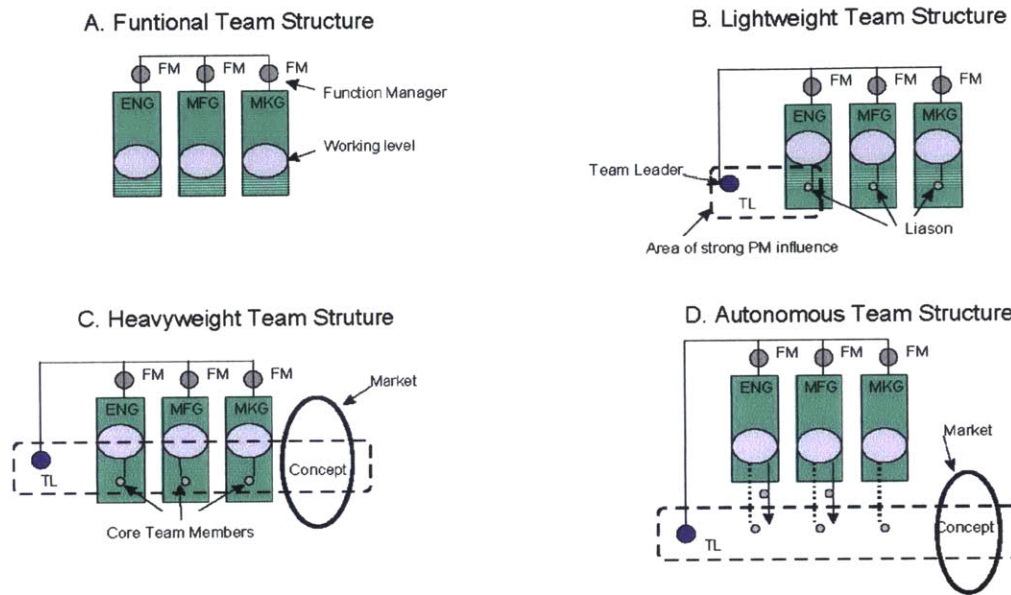
3.1 Organization Architecture in Innovation

To foster innovation, the organization structure in development process can be organized in many different ways. Clark and Wheelwright found four fundamental typologies to organization structure that encourage different level of innovation.³¹ Each team structures demonstrates a unique system of leadership, rewards, and communication among team members.

³⁰ "Innovation: A Guide to the Literature". The Oxford Handbook of Innovation. 2005

³¹ Ibid.

Figure 4: Development Team Structures³²



Notes: Figure 4 graphically describes the basic structure of four team structures. There are four types of team with various independence, and reporting structure: Functional, Lightweight, Heavyweight, and Autonomous. Chart A depicts the functional team structure, a team that are grouped by discipline and have a sub-functional manager as well as senior functional manager. Chart B displays a lightweight team structure where the teams are represented by a liaison person from each functional area, usually managed by a middle person who has little influence. Chart C is a heavyweight team structure where the manager of a heavyweight team has direct access to top management, and are responsible for the work of everybody involved in the project. Chart D displays an autonomous team structure, which allow the team members to create their own policies and procedures in the project beginning. They have no established boundaries.

As shown in *Figure 4*, there are four main types of organization structures which can be found in Thailand real estate industry:

1. The functional team are the most commonly used organization structure in large firms. The individuals are not assigned to a specific project. But they are dedicated to their specialized departments and assigned to do one aspect of a new product development. Their expertise is applied to any project and can be evaluated by components in a strong and sequential processes. The regularity of the functional team creates barriers to creative and collaborative process by decomposing the jobs into independent tasks, which can limit the cross-disciplinary communication in launching a new product type. Although the functional team structure limits innovation, it becomes highly efficient when there is an economies of scales.

³² "Innovation: A Guide to the Literature". The Oxford Handbook of Innovation. April 2006

2. The lightweight team is similar to the functional team but with a lightweight project manager coordinating across various roles. The lightweight project manager has no authority to guide the work of the team, but intended to improve the team's communication efficiency and product quality.
3. The autonomous team (specialized taskforce unit) represents a structure where individuals from various disciplines are assigned to one project team. Here, the team members, as a whole, are dedicated to one task and are free to propose their own organizational structure, while remaining independent from the larger holding company. The autonomous team structure creates an entrepreneurial culture which allows each team members to explore new ideas through combining various expertise. The project manager can integrate incentive of various specializations to propose an integrated solution. Here, the team is focused on results and objectives of the project.
4. The heavy structural team is where the project manager has the most control over the project and the team members. Like functional team structure, each team member is working under their functional departments which is opposite of the autonomous team where individuals are able to work across disciplines. Here, the heavyweight manager coordinate responsibilities across specializations. The strength to this structure is the improved communication and stronger project objectives. Consequently, a heavy structural team establishes a working environment with strong commitment to the project. In the heavyweight organization structure, there is a leader who proposes creative ideas and coordinate ideas to various team members. A careful communication skills are needed to cultivate contributions from each member to established a strong core concept and enough conflict resolution skills to ensure that tough issues are dealt with within the timely and cost efficient manner. The heavyweight structure is similar to that of lightweight team structure, but the heavyweight manager has more control over the project and team members.

The review of innovation typologies and organizational architecture creates a framework for case studies analysis in Chapter Six to investigate the motivation for green office buildings, associated risks from LEED certifications, and risk allocations among the development team and consultants.

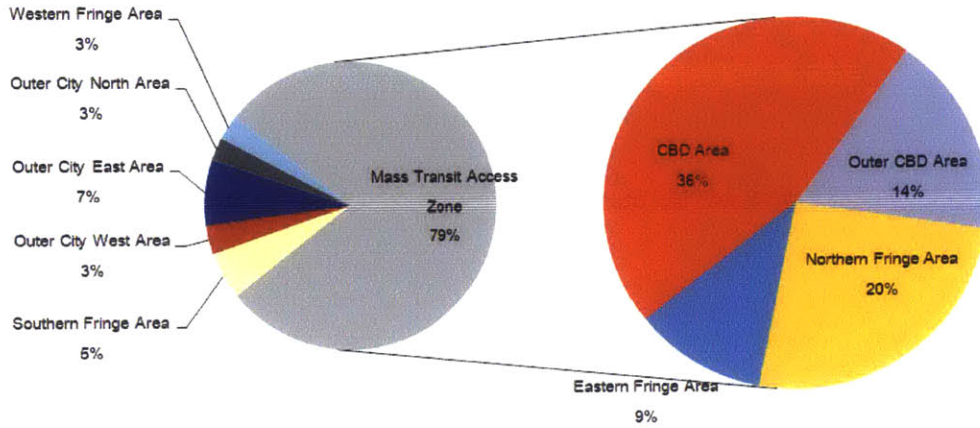
Chapter Four

4.0 Evolution of Commercial Office Product in Bangkok

Bangkok grew organically during its period of rapid expansion, first horizontally, extending along the built extensive roads network and vertically as the city densified. Here, the city has grown from the center adjacent to Chao Phraya river into the northern and southern part of suburban residential projects. The eastern and western part remain largely agricultural lands. Many streets of Bangkok are filled with vernacular shophouses which rapidly formed during the unrestricted buildings period in the 1980s. Now the city is filled with high rises that contradict with the sea of shophouses on the street level. Vernacular shophouses in Southeast Asia urban areas are mostly two or three stories high, with a retail space on the ground floor and a residential space above. Such hybrid building is scattered in historical centers, and are slowly deconstructed and replaced with high rises. Because of the limited building technology, early shophouses in the 1800s and 1900s were generally low rises. Cities such as Singapore and Penang, have renovated their shophouses into boutique hotels, modern retail shops, and café. Shophouses in Bangkok however, have been left old, or demolished so that the land can be redeveloped into Grade A office towers and giant shopping malls.

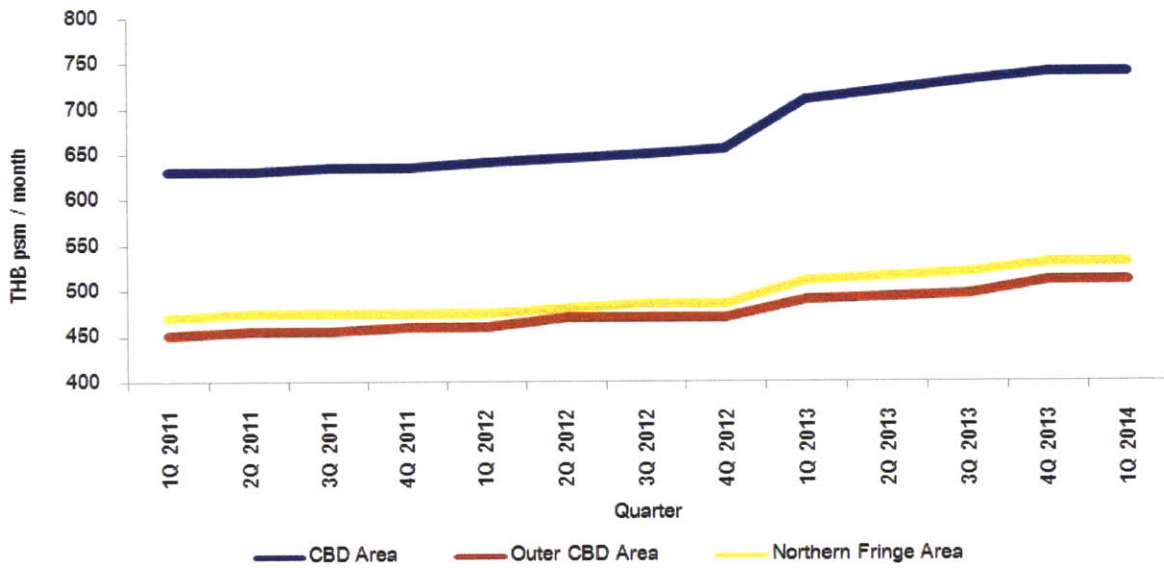
In Bangkok, the main competitive advantages for commercial building development are still location and rents. However, with corporates' CSR policy, and positive market dynamic promising higher rent premiums, the adoption rate of green buildings in BMA is growing rapidly. The rental rates of grade-A office in Bangkok have continued to increase with an average of 1.5%, and an average occupancy rate of 90.9%. Buildings with the highest rent premiums are centralized in the city. Approximately 70% of total new space will be grade-A office buildings, and 28% of new office space will be in the CBD. With the increase in land price in Bangkok CBD, and rapid expansion of mass transit network (BTS and MRT) from inner to urban and suburban of Bangkok, there is an increasing trend of new commercial projects in the Northern Fringe area.

Figure 5: Supply by Location³³



Notes: Figure 5 breaks down the office buildings distribution by area in Bangkok. The largest share of the office building market is located in mass transit access zone, with around 79% of the total supply. The mass transit access zone is subdivided in four areas: CBD, Outer CBD, Northern Fringe, and Eastern Fringe area.

Figure 6: Average Rental Rates³⁴



Notes: Figure 6 displays the average rental rates for commercial office property in Thailand over the 2011 period, categorized by three subdivisions: CBD, Outer CBD, and Northern Fringe Area. The left vertical axis is the average rent. The horizontal axis is the time period measured in quarters.

³³ "Research & Forecast Report: Bangkok Office Market 2014". Colliers International. 2014.

³⁴ Ibid.

Green construction is a quiet revolution and one of the fastest growing markets in commercial real estate industry. Although the mainstream attention for green building focuses on the positive environmental impacts, researches have shown that developer's decision to go green is rooted in the financial viability. For example, 54% of the respondents from McGraw-Hill's reports have shown that the top reason for building green is to reduce energy cost.³⁵ Only 24% of respondents responded that the green building's value to environmental impact was the driving force behind their involvement in the real estate industry. Although initial costs of green construction could be higher than conventional project, the long term cost savings in operations and maintenance could help recover those costs. Statistical research have shown that green buildings are expected to lower the operating costs up to 9%, and increase the building value by approximately 7.5%, and occupancy rates by 3.5%.³⁶ Therefore, it is crucial that the development team implement strategies for containing costs during the initial phases of the development process.

4.1 Conventional Office Building Development Process

Commercial office buildings and headquarters complexes are developed in two interwoven phases. The first phase is master planning. The second phase is office building construction. The first phase involves permitting, master planning, and the delivering of instructor and amenities. The owner of large plot of land may sell or rent their plot to another commercial office developer who then complete the vertical construction phases of the office buildings. It takes approximately two years for completion (ready to be occupied), depending on the size and project complexity.

The land owner generally acquires permits, produce preliminary master plan, and develops land including infrastructure with the goal of increasing the land value. With many stages and complications of the development process, the list below illustrates an overview of the major criteria that an office developer must answer to successfully execute conventional vertical office development for which the development team is responsible.

1. **Acquisition:** The office developer purchase/lend/partnered a plot of land with appropriate size and location. In selecting a development site, the office developers look at the parcel's accessibility to utilities, transportation network, and zoning.
2. **Financing:** Equity is essential at an early stage to move the project through approvals process. Heavy capital investment is required for the office developer for the office development and

³⁵ "World Green Building Trends 2016: Developing Markets Accelerate Global Green Growth". McGraw Hill Construction World Green Trends. 2015.

³⁶ "Thailand's Green Buildings Goals Aspirations & Realities". [Solidiance](#). 2014

construction before revenues can be realized from office rents. Large land holders for state-owned enterprises, such as PTT and SCG have the financial means for long-term capital intensive development.

3. Land Permitting: The land owner provides a general master plan for approvals. The land owner participates in the permitting phase of the land. This is one of the most value-adding process.
4. Office Construction: Various delivery methods and contractual forms are used, depending on the project complexity. The risks and rewards system in office construction are further discussed in the next few subchapters.
5. Tenants' interior construction: In addition to completing the office building, the developer must also select tenants and lease-up the office spaces. Here, the development team and property management must establish a set of guidelines to frame the interior construction process to meet the vision of the building as a whole

4.2 Sources of Risks in Development Process

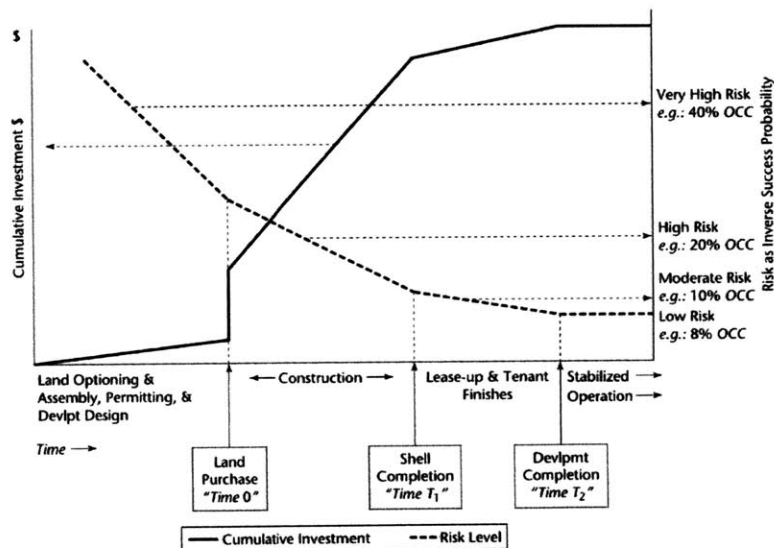
The focus of this thesis is risk and reward opportunities in real estate development. *Figure 7* illustrates a dynamic relationship between the opportunity cost of capital, and investment returns throughout the development process. Listed below provides the main sources of risk in green construction.

1. Timing risk. The office developer, like with most real estate development projects should develop at a right period in the market. However, if unforeseen complications delay the projects, the office construction will be less successful than originally planned. This could result in the slower realized revenue from rents out of the office, which can be damaging.
2. Regulatory risk. Gaining approvals for the development process of the office is the most crucial element to development. As the land is already permitted by the land owner of state-owned enterprise, and the royal heritage, it is one of the most value added that permitting approval generate. Therefore, land permitting is not a high risk paradigm. The approvals phase of the building development is comprised of high uncertainty. Typically, developer can approximate the time for approval to take, but the changes and concerns that town demand are uncertain. The regulatory risk, thus, is a great illustration of the associated unknowns, costs, and time of the process.
3. Financing risk. This is an essential ingredient to the success of the project. Here, the lenders, usually, through conventional sources such as the bank, are aware of most of the list discussed. The uncertainty of developing green building and lease out rate, at high occupancy, and constant political demonstration expose the project to strong market volatility. This could make it difficult

for the development team to meet the loan payments. Here, the uncertainties of the green office may increase risk of financing and cause financing through conventional sources problematic.

4. Design risk where the office developer is obligated to do a significant preliminary design planning and feasibility study to accommodate the new technologies and human capital knowledge in the various uses of the project. Here, the developer must assume risks of not being able to get the expected product quality or green infrastructure not performing the way it was supposed to. Typically, the design and performance risk is limited due to the traditional design and construction which require relatively little newly acquired knowledge. The cookie cutter office building minimizes the design and engineering risk. Typically, the developer and consultants interviewed were not highly concerned about the failure. However, the design and performance risk increases when innovation is introduced in the design, construction, and management of the green buildings. This will later be explored in Chapter Four.
5. Construction risk derives from an unconventional construction or construction delays which are the main concerns for all the development projects. Especially in green construction, the developer is exposed to price increase for special material, technology and labor costs which may not be readily available in Thailand. But with careful contractual and coordination among various team members, the developer can be insulated from the effect of increased construction costs.

Figure 7: Capital Investment Profile and Investment Risk Regimes in Typical Development Project³⁷



Notes: Figure 7 provides an overview of the development project investment process. The horizontal axis represents time. The left vertical axis represents the cumulative total amount of financial capital expended on the project up. The dashed line referenced to the right-hand axis represents the degree of risk faced by investors. The horizontal timeline axis is divided into phases: Preliminary phase, construction, lease-up, and stabilization. The riskiest phase in the development process is indicated by the height of the dashed line.

³⁷ "Commercial Real Estate Analysis and Investments". 2014. Exhibit 28-2. p.734

4.3 Risk Mitigation through Delivery Methods and Contractual Types

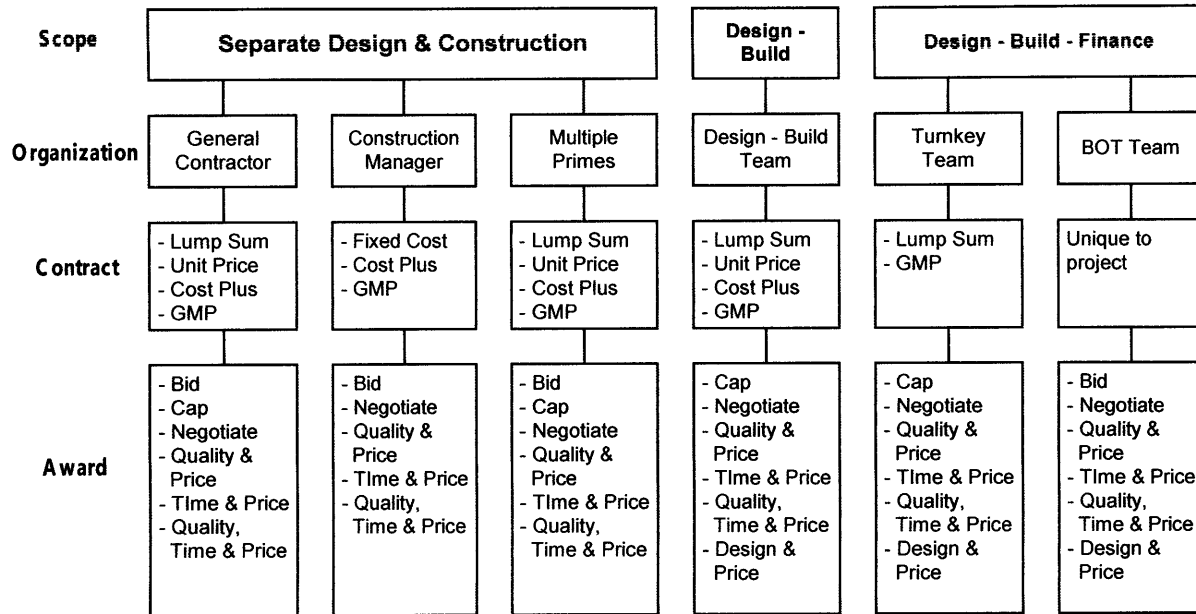
Project delivery method is a system that a developer or principle establishes to structure the design, construction, financing, and process of a project. The following is a process that shapes the delivery method, assigns risks for each phase of the case studies. The four elements that will help define suitable project delivery method: Scope, organization, contract and award, and selection method.³⁸

1. Scope of work estimates the design and construction works to assign to parties for the project organization. The scope includes the design, construction and finance task.
2. The organization structure refers to one or more parties with whom the developer or principle holds contract to accomplish each phases in the project, particularly design and construction phases. The team structure may include architect, planner, construction manage, general contractor, and any similar entities.
3. Contract form manipulates how the consultants and contractors are incentivized. Contract type can include lump sum contract that distributes fixed payment for a specific scope of work to a unit price. This requires a specific amount for each job component, time, and materials contract where the developer is responsible for all the hourly wages and material involved in the specific work. The contract type covers how the consultants are paid and their risk assumptions. For example, the lump sum contract assumed that all additional unanticipated costs of the job go to the contracted entity because the entity has guaranteed the fixed price. In contrast, the time and material contract situates the risk on the developer who pay the consultant for every work hour. The developer must pay for the extra hours than the anticipated and the material rise. Importantly, the contract type illustrates a tradeoff between development product as a commodity or specialized product. Typically, the commodity product flavors a lump sum contract because the product is traditional and predictable. Specialized works in green buildings are riskier and require a unique project management methodology, and communication process that can expose the developer to unexpected challenges and additional barriers to implementing a successful green office building. Within each case studies, the consultants negotiate contractual terms to move away from risks because they are not able to control the scope of works, time and costs in the same way as if the works were commodity.

³⁸ "Constructability of Construction Contracting Methods with Projects and Owners" M.S. Thesis Massachusetts Institute of Technology. Exhibit 28-2. 1991.

4. Selection Method is a process that consultants and contractors are chosen. In Thailand, competitive bidding is the most common method employed to select the most competitive and market price give the scope of the work.

Figure 8: Construction Contracting Method Components³⁹



Notes: Figure 8 breaks down a possible decision making process of the developer by the common components of project scope, organization, contract, and award parts.

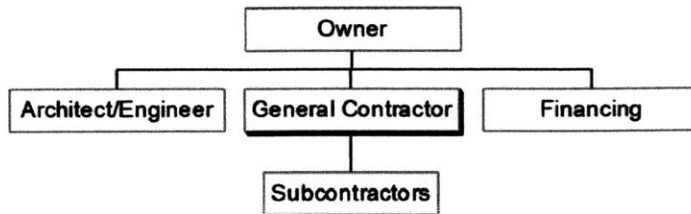
To select a particular scope, organization, contract, and award, as well as to finally combine them into the appropriate contracting method for the project, a developer must process through four main stages, as illustrated in *Figure 8*. In many cases there is no one single best method, but several that are appropriate.

Organization Methods

In his MIT Master’s thesis, Gordon provides six organization methods that has different risk allocations. Below is an abstract version of his thesis, and strategies used in the construction industry. This is done to set a firm foundation on methods of controlling risk using appropriate project delivery methods and contractual types to conduct the case studies analysis.

³⁹ “Constructability of Construction Contracting Methods with Projects and Owners” M.S. Thesis Massachusetts Institute of Technology. 1991. Figure 1. p.10

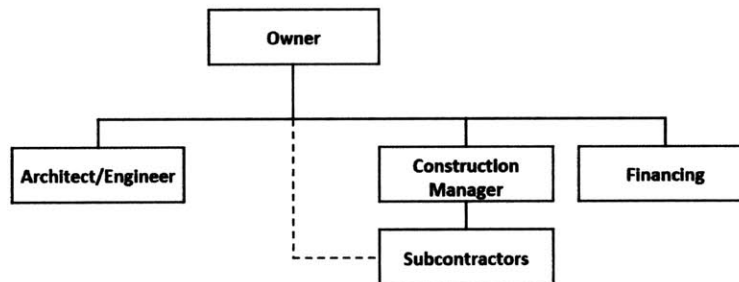
Figure 9: General Contractor Organization Chart⁴⁰



Notes: Figure 9 display a general contractor organization – A single business entity acting as the contractor in complete and sole charge of the field operations, including the marshalling and allocation of manpower, equipment, and materials.

Figure 9 represents a general contractor (GC) organization chart. This is the most conventional method of project delivery which divides the responsibility of design and construction. Here, the developer generally ensures the financing and design process, which can be delegated in many means. The office developer can be responsible for the full management of the design, or distribute to the design expertise who is also a project manager. The construction phase of the project is bid out to a GC after design and construction drawings from the architects are finished. The GC is in charge for the whole project delivery. The GMP or lump sum is generally used for the contracts. There are two main downsides to the GC method. Firstly, the developer doesn't have enough experience in construction for the design phase. This means that the developer doesn't have adequate methods to evaluate the expected costs for the green design. Therefore, the developer has few chances for cost control during the construction because the development team has limited control over the process. It is also harder and more expensive for developer to make changes during construction.

Figure 10: Construction Manager Organization Chart⁴¹



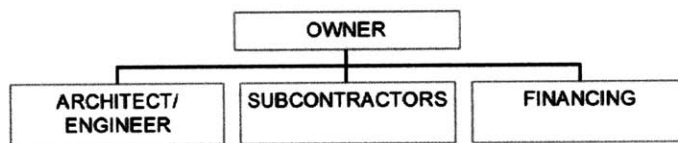
Notes: Figure 10 display a construction manager organization – A single business entity acting as a construction consultant to the owner and project manager, either for fixed fee or a fee as a percentage of the cost.

⁴⁰ “Constructability of Construction Contracting Methods with Projects and Owners” M.S. Thesis Massachusetts Institute of Technology. 1991.

⁴¹ Ibid.

As shown in *Figure 10*, the construction manager (GM) is where the CM is brought into the design and construction phases of the project. In contrary to GC, CM method provides the developer with construction expertise for evaluating the design and construction management during the construction phase. The consultant generally negotiated a fee as a percentage of cost or fixed fee basis. This process can increase cost during the design period, but it can reduce cost during construction, thus, increases the overall savings. The CM manages subcontractors, budgets and schedules during construction phase. Here, there are many different types of contracts. A unit price or a fee based on percentage of cost provide the advantage of aligning the interest of the CM with the developer, while shifting away the risk to the CM. Consequently, the developer prefers to use GMP to shift the risk to the CM, while maintaining a suitable pricing. However, the developer is responsible for financing in GC method.

Figure 11: Multiple Prime Organization Chart ⁴²

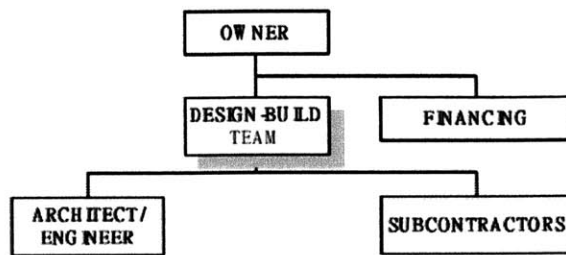


Notes: Figure 12 display a multiple prime contractor organization – More than one contractor holding contracts directly with the owner to perform specific parts of the same project. The contractors can be general contractors overseeing various trades, or subcontractors performing one trade. The owner is responsible for overall project management and coordination, replacing a general contractor or a construction manager.

Figure 11 provides organization chart of multiple prime method. This method shifts the risk to the developer who manages the whole project by contracting the consultants for design and construction phases directly. The developer is responsible for the financing. Multiple prime is a time consuming method by allowing the developer the most influence on the design in every phases of the project to control the cost and time. Consequently, this method provides the greatest financial incentive to the developer because any savings on costs will be given to the develop. This is a high risk method that requires a sophistication and experienced development team to allow flexibility and construction management to the developer.

⁴² “Constructability of Construction Contracting Methods with Projects and Owners” M.S. Thesis Massachusetts Institute of Technology. 1991.

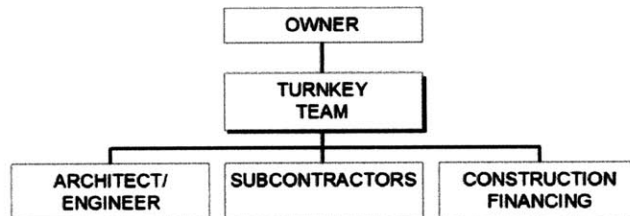
Figure 12: Design-Build Organization Chart⁴³



Notes: Figure 12 display a design-build organization- a single business entity that performs both the design and construction of a project. The team can be one company or a partnership of firms.

Figure 12 illustrates a design-build method organization chart. Here, the risk and responsibilities of design and construction are allocated to a single business entity who is responsible for most of the project risk. The developer doesn't have a lot of control over the design process, thus, realize savings. The services and product delivery costs are also higher because of high risk premium than if the developer controlled the project delivery directly, which is similar to the multiple primes method. The design-build method is suitable for traditional products where developer has not special design needs, allowing the developer to move the control to the design-build team and increase the speed of the project delivery.

Figure 13: Turnkey Organization Chart⁴⁴



Notes: Figure 13 displays a turnkey team organization – one business entity that performs design, construction, and construction financing of the project. Payment is made at the completion, when the contractor turns over the “key”.

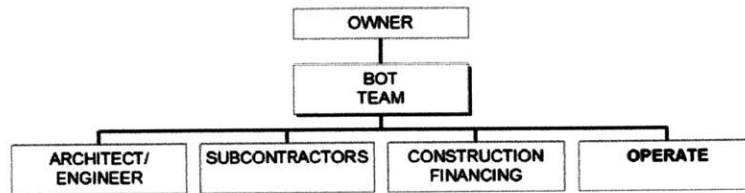
Turnkey is the method which has the same characteristics as design-build but one key different. Here, the turnkey is responsible for project financing. Like the name of the method, the developer makes payment for the finished product when the key is turned over. Typically, the office developer shift risk away to the

⁴³ “Constructability of Construction Contracting Methods with Projects and Owners” M.S. Thesis Massachusetts Institute of Technology. 1991.

⁴⁴ Ibid.

turnkey team completely by paying higher, because of higher risk premium, and accepting less reward for the development.

Figure 14: Design-Build-Operate/ Design-Build-Transfer Organization Chart ⁴⁵



Notes: Figure 14 displays a build operate transfer team organization – one business entity that performs the design, construction, construction and long-term financing, and temporary operation of the project. At the end of the operation period, which can be many years, operation of the project is transferred to the owner.

Design-Build-Transfer (DOT)/Design-Build-Operate (DBO): Similar to the design-build and turnkey methods, the DBO/DOT operates in one business entity that is responsible for design and construction of the project. The team also provide the project financing, like the turnkey. But the biggest difference is the team will also operate the project for a contracted period of time and collect profits before turning over the project to the developer. DBO/DOT are typically implemented for large infrastructure projects such as bridges and highways. By employing such method, the developer minimizes the risk and capital investment in the project because the such method uses the operation phase to generate their savings and returns.

Conventional Delivery Method for Office Buildings

The overview above describes the conventional delivery methods that represent majority of developers’ decision making process when drafting the contract forms and project delivery method. For office development in BMA, design and construction is mostly conducted on a general contractor basis where the main contractors are contracted directly with the developer. Contract types can be negotiated depending on the preferences of the developer. This typical methodology suggests that developers do not need much construction sophistication, construction management capability, and risk tolerance. A well selected project delivery organization allows the development team to remain fairly lean throughout development relative to the scale of the project.

⁴⁵ “Constructability of Construction Contracting Methods with Projects and Owners” M.S. Thesis Massachusetts Institute of Technology. 1991.

Part II

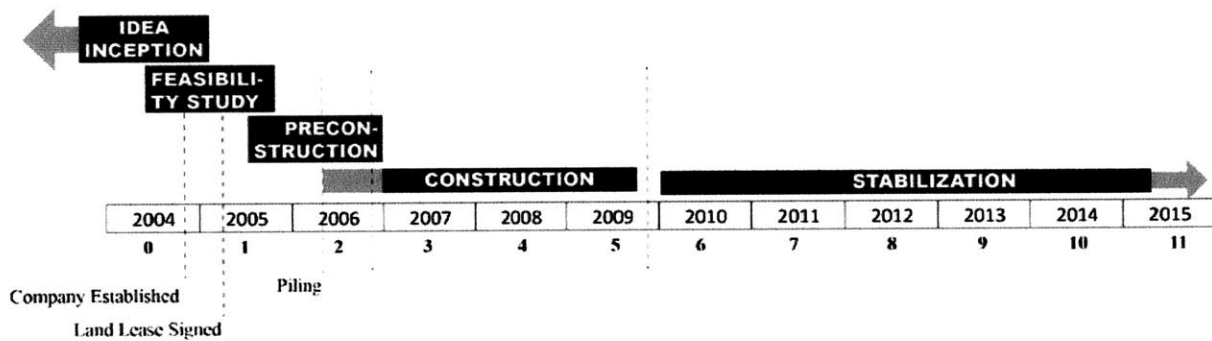
Chapter Five

5.0. Case Study Agenda

Part One of the thesis has laid out foundations for case studies analysis in the proceeding chapter. It has covered four crucial elements: green office development in Thailand's green market that acts as product innovation, the innovation typologies, organization architecture, and lastly, the office development processes using project delivery methods and contract forms for risk mitigations. The thesis uses five green office projects to understand and locate the innovation of green office development, and process of risk distributions in innovation through project delivery methods analysis.

MIT Master's thesis of Benjamin Bulloch and John Sullivan, and the development timeline of Energy Complex are examined to understand the development process, and develop interview questions framework for the case studies analysis in Chapter Six.

Figure 15: Development Timeline of Energy Complex⁴⁶



Notes: Figure 15 is a conceptual diagram that shows the various phases in a typical construction commercial office project in Thailand: Idea Inception, feasibility study, preconstruction, construction, stabilization which covers tenant lease-up and operation. Here, the Energy Complex development timeline is used as an example. The lighter shaded grey represents the overlap in the phases, the work generally flows from one phase to another, with the outcome of one phase providing the basis for efforts carried out in the phase that follows.

⁴⁶ Construction and Project Manager of Energy Complex. Interview by Author. August 2015.

Listed below are six major phases in the development process discussed in the Master's thesis of Bulloch and Sullivan.⁴⁷

1. **Idea Inception:** In this stage of development, a developer is forming ideas. A developer seeks to provides a product that meets the market demands. This process is initiated when the developer is either identifying sites looking for a use or a use looking for a site. During this stage, the developer is attempting to understand major factors surrounding the development, including market conditions, design possibilities, zoning and political restrictions and financial possibilities. The stage ends when the development idea for the parcel is feasible enough to invest in extensive series of feasibility studies. Here, the land deal is negotiated and a deposit is made.
2. **Feasibility:** In this phase, a developer identifies the highest and best use for the site within the political, cultural, economic, and physical constraints he/she has identified. The developer is engaged with feasibility consultants to gather information required and develop a single best proposal development for the site. Here, they will develop preliminary market studies, massing studies, conceptual design, and legal processes in a more detailed analysis than the previous stage.
3. **Preconstruction:** This stage resolves the design and development to commerce the project construction. Various consultants are working together through multiple schematic design, design development, and construction documents. Public approval process is completed at this stage. The developer also conducts market studies and leasing strategy to verify the design and schedules. The budget overruns must be revised or request design team to make additional changes. All sources of capital should be secured. Soft costs are paid for with developer's own equity.
4. **Construction:** In this stage, the contractor and subcontractors are responsible for construction based on the design and specifications confirmed in the preconstruction stage. Here, the market and financial assumptions are constantly evaluated.
5. **Stabilization:** After construction is finished, the building obtains an occupancy certification, allowing the building to start being used for its intended purposes. Here, tenant starts to move in, allowing the developer to start collecting rents. The financial underwriting are constantly updated. Stabilization continues until a constant level of occupancy and cash flows are achieved.
6. **Asset Management (Operations):** After stabilization, the developer can manage the asset and collects cash flow or sells property to generate fast cash. In this stage, a developer examines the

⁴⁷ "Application of the Design Structure Matrix (DSM) to the Real Estate Development Process" M.S. Thesis Massachusetts Institute of Technology. 2009.

value of the property market, developer's financial objectives, and the larger organization's long term business plan.

5.1 Methodology

The thesis develops a set of questions using interview questions from the Beijing's Case Study Investigation at MIT Real Estate Entrepreneurship Lab as a framework for conducting series of interviews with the major stakeholders in each case studies. These questions go through six major phases (Idea Inception, feasibility, preconstruction, construction, stabilization and asset management) of the development to understand green office development process with the goal of gaining insights into barriers and opportunities in green construction. These questions are adaptable for the key players to establish the green development narrative. To implement an unbiased survey and learn about the developers' experience objectively, the questions are filtered in a way that does not imply the answer by approaching the topics from a general perspective, without giving a detailed background of what prompted such questions. The topics and questions covered in interviews include:

Company Background and Firm Value

The Real Estate Development Team:

1. What led the firm to establish the real estate development department?
2. How many projects have you developed since the opening of the department?
3. What are the completed projects? What are the on-going, and future projects?
4. Who were the stakeholders to the development process?
5. What is the organization of the development team for the project? What was optimal and suboptimal about the different roles and actors within the team?
6. Can you tell us more about the development timeline?
7. Who are the key team members that could help us understand how your parent's company/holding company establish the real estate department/project? Are there key designers, planners, or financiers that we can engage with to understand the development process further while I am in Bangkok?
8. Is there something we are missing in learning about your experience?

Project Expectation:

9. Can you tell the story of the firm's real estate development department in the context the larger organization and business plan?
 - a. What was your vision for the commercial office development at the time?
 - b. Can you outline your approach to developing this project?
 - c. How did the firm start to establish expectations for the development?
 - d. How did the final development meet those expectations?

Green Initiatives:

10. How does the real estate department select a green building certification scheme?
11. What is the role of sustainability and energy efficiency in the real estate development department?

12. How was the sustainability and green certification idea conceived?
13. Does sustainability play a role in your larger organization?
14. What are the core aspects of any sustainability vision that the firm has? If these aspects are goals, how does the firm measure if the goals have been met?
15. Which green certification scheme did you choose?
16. Were other green building certification scheme's considered?
17. What was the target certification level for the building?
18. Can you describe the design and construction strategy for targeting a LEED development?
19. What were the design and constructions costs?
20. Did you employ consultants or outside design services?
21. What is your strategy to reinforce creativity within the team and encourage green development ideas across different teams?
22. How has LEED certification played a role in your marketing and leasing strategy?
23. How was the rent calculated?
24. Do you think LEED certification has allowed the project to command a rent premium so far? Why or why not?
25. During the feasibility study, were the following initial values the same or different from the values during the stabilization? And if different by how much?
 - a. Design and construction cost, occupancy rate, lease term, payback period, building image, investment cost, effective rent?
26. What are the general attitudes about developing a green building in Thailand?
27. What are the aspects of green building that are important for Thailand?
28. Has certifying the project with a green label increased the risk and return of the project over the whole development horizon include: design phase, pre-construction, construction, lease-up, and stabilized delivered asset to the market or client?
29. What was the most challenging aspect developing a green building in Bangkok?

Green Building Development Phase

Idea Inception & Feasibility Study

30. Market analysis:
 - a. What type of demand/clients that your project is serving?
 - b. What aspects of a market analysis did you conduct?
 - i. Macroeconomic analysis, evaluate capital markets, local supply and demand analysis, estimate rents, estimate costs
31. Physical and Design Analysis:
 - a. What were the aspects that came into play to help set and evaluate the physical location?
 - i. What was a set of constraints around the property parcels? Were you looking for a site in mind or a concept in mind? And at what stage does the development team understand the type of land/product needed?
 - b. How did your team determine the project scope? Eg, the number of floors and office space required to make the investment viable
 - c. Did you evaluate multiple programmatic options for the site? Eg. Hotel, office, and retails?

- d. Engage feasibility consultants:
 - i. How were the team members selected? What were the company crucial selection criteria?
 - ii. How was the selection process different from the conventional office? Was it required that the team must have green specialists within each firm?
 - iii. Who were the stakeholders to the development process?
 - iv. What were project timeline for bringing in different stakeholders into the project?
 - v. Who are the contractors for the project?
 - vi. Who is the legal counsel for the project?

32. Planning and Entitlements:

- a. How did you work with local governments to acquire the land?
- b. Do you have a team that works to evaluate zoning and planning?
- c. What is the strategy for entitlements and construction permits?
- d. Because the project is developed in an urban prime location, is there a level of “community” engagement that needs to be explored to engage stakeholders in the development process?
 - a. External Stakeholders
 - i. Who are the external stakeholders in the development project? Neighbors, the public, politicians, competitors.
 - b. Permits and approvals
 - i. What the anticipated building permits needed to get the structures off the ground?
 - ii. Were there specific approvals that need to be acquired to align the project with LEED certification?

33. Financial Analysis:

- a. Was there an equity partner for this project?
- b. What were the debt or equity options throughout the project development?

34. Development Firm Strategy:

- a. What is the firm’s organizational structure for developing the land?
- b. What is the risk tolerance level of the development firm?
- c. Team structures: what is the relationship dynamic among each players? How was the project management team integrated within the development team?

Preconstruction & Construction

35. Market and Competition Analysis:

- a. What were the marketing and leasing strategy for the property?
 - i. Were there any anchor tenants for this property? Did you have to make formal commitments with the anchor tenants for the bank to see?

36. Consulting Team engagement:

- a. What were your process of securing a major stakeholder such as contractor, architect, project management team? How were the major players selected?
- b. How was the organization and contracts structured between each team?
- c. How were the incentives and payment distribution system structured?
- d. Did the selected firms sub-contract to other firms for certain functions?
- e. Facilitate Innovation:

- i. How willing were the different players to work together? What incentives were utilized to facilitate collaboration?
- ii. Were there any major issues caused by the unfamiliarity and lack of education of building to the standards of LEED in the process?
- iii. How do contracts and incentives encourage flexibility in green construction?
- iv. Was there additional decision making processes that must be integrated to achieve completion when compare to developing traditional office?

37. Monitoring schedule and budget:

- a. What were the major challenges you and the team faced if any, during construction? And how did you overcome them?
- b. How was the design fee, services, superstructures and fittings costs of this project compared to other office building in the area?

Stabilization & Asset Management:

38. Marketing plan:

- a. How are green initiatives incorporated into the marketing and leasing plan for the office spaces during lease-up? Did you hire another team for marketing the property?
- b. How did LEED certification play a role in marketing and leasing strategy for tenants?

39. Financial Benefits:

- a. Can you tell more about the operational advantages, if any, from certifying the project with LEED? How are the water, electricity, and maintenance costs of the project compared other office building in the area?
- b. How was the water, electricity, and maintenance costs of this project compared to other office building in the area?

Green Office Trend and Development Model

- 40. Where do you think are the public role in the green office development?
- 41. How will LEED v.4 affect the commercial real estate development?
- 42. What do you think are the trend for green office buildings in Thailand?
- 43. Is there something that we are missing in learning about your experience?

Nature of the interview: To facilitate a candid conversation, the name of the interview and their respective company are kept confidential. Interview length ranged from an hour to two hours of conversation in person.

Chapter Six

6.0 Energy Complex

Holding Company and Project Overview

Founded in 2004 by PTT Plc., and PTT Exploration and Production Plc. (PTT EP), Energy Complex Co., Ltd (EnCo) was established as an integrated group of office buildings for PTT affiliates, energy companies, and Ministry of Energy with the goal of saving business communication time, and thus boosting operating efficiency, and reducing expenses. EnCo is first commercial building to attain LEED certification outside of the US, and the first commercial office complex in both Thailand and Southeast Asia to be awarded with the highest Platinum level from LEED for Core+Shell v.2. The iconic trophy office is used as a demonstration of PTT Group's resolute determination to pursue the energy business in sustainable manner by integrating energy efficient utilities and energy conservation.

EnCo is composed of two office towers, connected by one service tower, and outlined by parking structures. The five towers form a combination of oil drops and rising frames, while forming an open space and a green area which are cumulatively higher than the requirement of the Bangkok Administration by 287%. Tower A is a 36-storey office building in clear green glasses which are curved based on aerodynamics to reduce outside heat. Tower B is a 25-storey office building with curved glass façade which resemble the rising flames to reflect Tower A. Tower C is a 8-storey recreational facilities and retail area for the office workers.

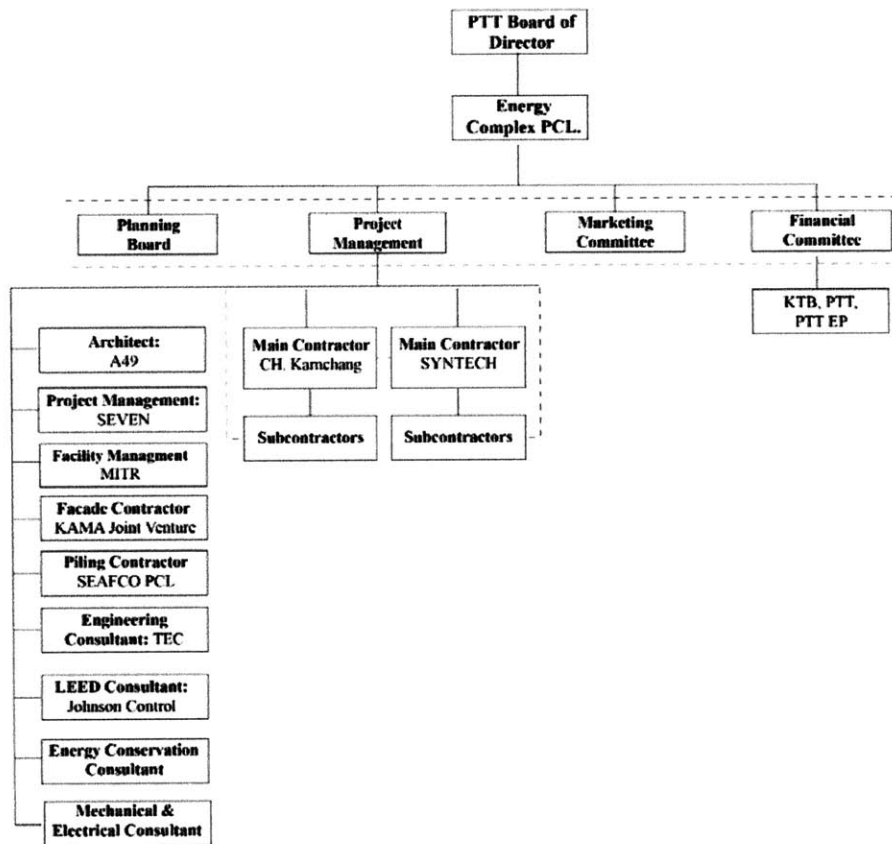
Development Process

The idea conception stage took approximately five months. The architect was hired to analyze the site and programmatic layout. Although EnCo was established with a sustainable approach, the PTT committee decided to integrate a third party organization green certification program in the project after piling and construction already had begun. The late changes in the project scope has tremendously increased the budget and shifted the construction timeline. EnCo formed a development team of 8-10 people which consist of existing in-house employees and new hire engineers. Here, the feasibility study took approximately 14 months from 2004 to 2006. EnCo also took on a side project on building new homes for the existing residents of the sites which took 10 months. This sunk cost operation was carried by additional general contractor. The project management company was hired to facilitate the design and construction bidding, as well as to supervise the construction. Two main contractors were brought into the projects to conduct a 36 months' construction.

Delivering

The construction of Energy Complex was executed by two general contractors. The construction contracts were typically on a lump sum basis. Because of the project's late change orders to include LEED certification, some contractors were contracted informally to accommodate a tighter and a more complex construction work schedule. The consultants employed during design phase were on both lump sum, and a time and materials basis. The combination of these mechanisms placed much of the risk on the consultants. In this case, the consultants assume a risk that is typical in the development industry- getting paid for their services.

Figure 16: Energy Complex's Organization Structure



Notes: Figure 16 demonstrates the project organization chart gathered from a series of structured interviews, showing contractual relationship with different parties. The dashed lines at contractor indicate contracting with the subcontractors. The development team is encompassed by a dashed rectangle, indicating a shared responsibility and cross multi-disciplinary of each team members.

Project Team Structure & Delivery Methods: The development team is a functional team of 10 people with a heavyweight manager. To form the development team, PTT experts were transferred to EnCo, and outside specialized profession were hired. Working an integrated decision throughout the development process, the design and construction professionals were contracted directly with EnCo, not PTT. Here, the team structure parallels to that of Ritta HQ, while different delivery methods were utilized. This type of team structure has less entrepreneurial spirit because the team essentially assumes a heavyweight structure under the project management. However, by having a functional development team and a heavyweight manager, the team members are able to be assembled such that they can work on multiple projects with PTT within their field of expertise. Although this type of team allows for the most efficient operation within the larger and more complex organization of PTT, it does not facilitate product innovation. The project budget is flexible enough, such that the project scope was able to be adjusted by integrating LEED criteria into the construction documents when the construction already had begun.

Team Selection: The design team and main contractors were selected through competitive bidding. During idea conception phase, the design consultants were hired based on the firm reputation and existing relationship with PTT. Similarly, KTB, the financial partner was chosen because the long term relationship with PTT. However, as the project moves into the design and preconstruction phases, the consultant firms were chosen in competitive bidding based on work quality, experience, work schedule, and reputation. Consequently, the design and construction risks were further diminished through competitive bidding. Nonetheless, EnCo approached a particular consultant, such as a facility manager for a discrete scope of work, and negotiated a contract that would allow for the flexibility of the project schedule and scope as there were many change orders during constructions. Throughout the development process, in-house engineers coordinated documents and project schedule to ensure that the project conform to LEED criteria. Towards the end of construction, a LEED consultant firm, Johnson Control was brought in to comply with the LEED standard.

Contract: Site and programmatic analysis during idea conception stage were done in by in-house staffs and outside specialized consultants hired for specific scope of works. During feasibility study, A49 was brought in and were contracted on a lump sum basis for the conceptual and preliminary studies. Here, the developer was able to shift some of the design and innovation risk onto the consultants because of the dominance of lump sum contracts in design and construction phases. This type of contract are typical of the local development industry.⁴⁸ Two main contracts, CH. Kamchang, and SYNTECH both agreed to

⁴⁸ Construction Manager, interview by author, August 2015.

lump sum contracts, allowing EnCo to manage costs, and shift most of the cost risk to the consultants. The cost of the project was more predictable because the consultants' past experiences on other similar projects. However, the consulting firm may also apply risk premium for the general cost risk associated with a lump sum contract, especially for an unconventional green product.

Risk Allocation

1. **Regulatory Risk:** EnCo's regulatory experiences has more risk than the other cases because PTT has to reallocate the existing residents of the project site into a new area. This was a stage of high capital investments and high timing risks because EnCo was responsible for two construction projects, building EnCo office complex, and rebuilding residential settlements. While the regulatory phase certainly present high risk during idea conception phase, incorporating LEED certification criteria into the project did not increase regulatory risk. The project thus has a low regulatory risk from building green.
2. **Design Risk:** EnCo experienced a higher design risk than the other developer because LEED criteria were added only after construction had already begun. Although there was no in-house designers, the in-house engineers were able to control the design and construction costs through collaborating and examining construction documents and budgeting with A49 and contractors, thereby lowering the risks of the modified design not meeting PTT's vision. EnCo hedged against design risk by hiring experienced designers and engineers to conduct extensive research on energy-efficient design and site planning.
3. **Construction Risk:** Working with two general contractors within the same project significantly increases construction risk. Construction phase required an outstanding project management team as the work schedule of several subcontractors must be well coordinated to complete the construction of the green development smoothly. By having a project management firm supervised by PTT in-house engineers, EnCo was able to oversee the costs, ensure quality assurance, and lessen the liability. EnCo's construction phase is the most intrusive and educational for the development team because as the most certified LEED platinum office building, there were many change orders that came from careless mistakes and miscommunication between designer and contractors. Such as, the contractors have to order new materials because the architect miss identified LEED specification for construction materials.

Organization Architecture and Innovation

The EnCo case highlights the importance of process innovation by forming a well-structured and diverse team with strong leadership to conceive a LEED certification product at platinum level. The heavyweight manager helped the functional team to collaborate with the goal of encouraging product innovation of EnCo. Process innovation in this project was extensive because the engineers found new ways to execute his visions through more subcontractors oversight. The project is ambitious in that the PTT committee decided to pursue LEED certification after piling already have begun. Through informal contracts and established relationships, EnCo was able to shift some of design and construction risks to the consultants. Although much responsibility is allocated to the consultant, the developer bears most risk in ensuring that the final product would not deliver expected returns. This type of risk allocation is appropriate because specialized engineering and construction firms were able to lead the LEED certified development by giving the consultants incentives to execute the project and assign them complete control and opportunity to realize savings and a risk premium through the lump sum contract.

6.1 Park Ventures

Holding Company and Project Overview

Park Ventures is developed by Univenture Plc., a company that has a diversified business line in property development, property management, oxide manufacturing, and energy sector investment. The company acquired the right to develop the project land parcel through competitive bidding. Univenture proposed to establish a landmark building that responds to the needs of the community by being environmentally conscious. “Ecoplex on Witthayu” is Univenture’s goal to develop an energy-efficient and environmentally friendly project through design and construction innovation.

Park Ventures Ecoplex is situated at the central district of Bangkok, a site of growing culture, and historical importance. It has a close proximity to the main shopping district, Siam Center, of about 400 meters. Park Ventures has provided an ideal microcosm for office workers of near 2,000 employees. With the direct connection to BTS skytrain, Park Ventures is at the forefront of anticipated growth surrounding Ploenchit station. Located on 2.6 acres of land, Park Ventures is Thailand’s first LEED platinum mixed-use building.

Development Process

Univenture hired a branding creative consultant to work closely with the management team with the goal of establishing a consistent project’s identity throughout the development process. The branding consultant worked with all other consultants, such as, designers, property development team, office space

management team, and CBRE. Much of the master planning that governs Park Ventures was influenced by the vision of Univenture and Palmer& Turner, to provide the community with an urban oasis. Consequently, Univenture has cultivated a unique office and hotel product that focuses on preserving open space. Although Park Ventures is Univentures' first commercial office product, the development team did have previous experiences which allowed the teams to export the managing director's vision and permit expertise to the Park Ventures project. Because delivering a LEED platinum certified office building was very new to the real estate industry in Thailand, local labor had little familiarity or almost none to green construction management. Consequently, Park Ventures hired an outside green consultant to collaborate with the key players throughout the development processes.

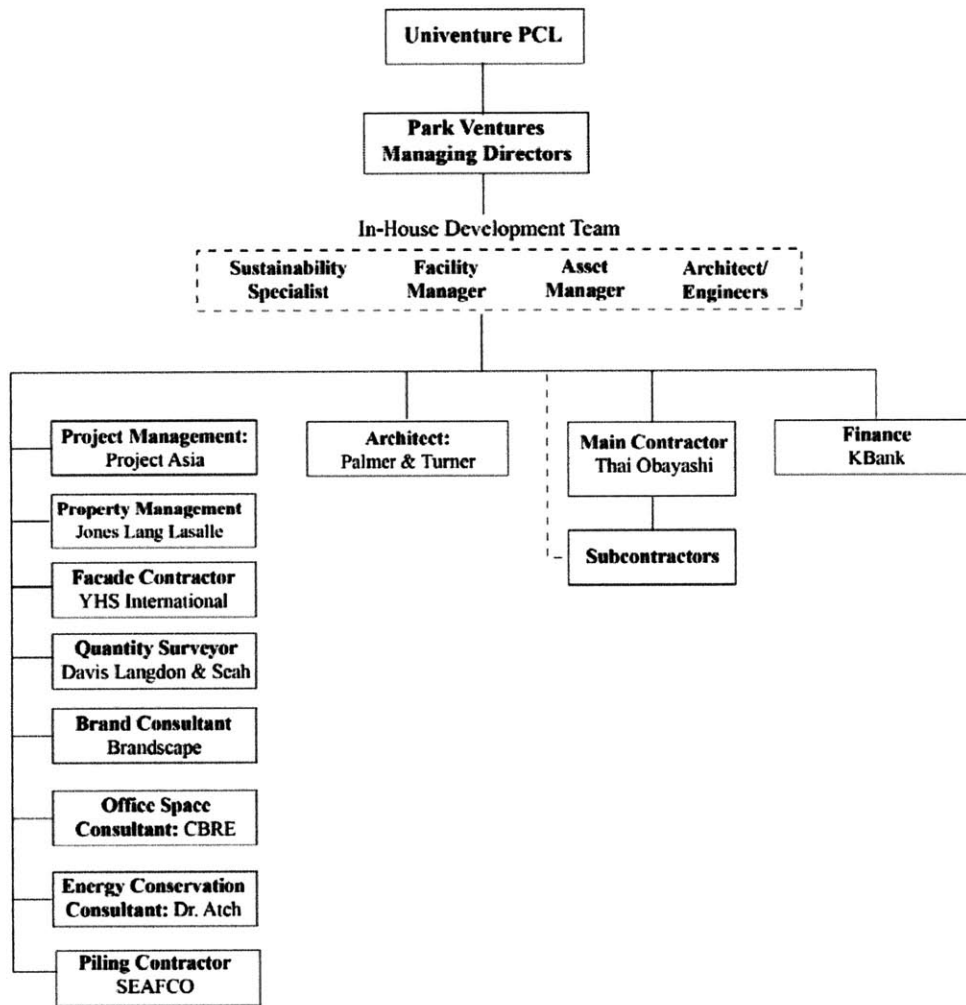
Delivering

Design and construction of the Park Ventures were performed through a general contractor, contracted through a lump sum basis. Similar to that in Energy Complex, design phase contracts were on a lump sum basis with Palmer and Turner, and the consultants were on time and material basis. The combination of these mechanism placed much of the risk of the project on the consultants. Park Ventures development team has a clearly defined scope of work in a linear and timely manner.

Project Team Structure & Delivery Method: The development team, as shown in *Figure 18*, is an autonomous team with a heavyweight manager. Thai Obayashi and most subcontractors were contracted directly with Park Ventures. The development team and Project Asia, the project management team, coordinated the design consultants to direct the work product toward the same vision. Park Ventures transferred in-house staffs from Univenture, as well as hired new members to establish a specialized development team for this project. In part, the Park Ventures conveyed a greater sense of independence form of conventional team with greater organizational flexibility because of the project's high entrepreneurial spirit. The development team were small and consisted of 4-5 people, providing opportunities for a fluid interaction. Begun with an end concept in mind, the project budget and timeline were set during the idea inception and feasibility stage, which were well before the completion of construction documents.

Team Selection: The development team was rather lean. The success of the team selection has been to strategically transfer in-house staffs for the most important and trustworthy experts within each phases of the development. Park Ventures selected the main contractors through competitive bidding where Thai Obyashi was chosen mainly because of existing relationship and reputation. Park Ventures approached green consultant fairly early in the design process in corporate LEED criteria into the project master plan.

Figure 17: Park Ventures' Organization Structure



Notes: Figure 17 demonstrates the project organization chart gathered from a series of structured interviews, showing contractual relationship with different parties. The dashed lines at contractor indicate contracting with the subcontractors. The development team is encompassed by a dashed rectangle, indicating a shared responsibility and cross multi-disciplinary of each team members.

Contract: The site analysis was executed by in-house staffs. For extensive design studies, Palmer & Turner was selected and contracted on lump sum basis. The green consultant for Park Ventures was contracted on a time and material basis as green development is still a new product in the market. The main contractor was contracted base on a lump sum, allowing Park Ventures to manage costs and shift risks to consultants. Here, there is a low risk during design and construction because the development team is well prepared by planning the project with green concept in mind, and incorporating regular sustainable education sessions for various teams throughout the development process.

Risk Allocation

1. **Regulatory Risk:** Park Ventures' regulatory risk from LEED certification was low because incorporating green criteria did not require extra land permitting process. Upon signing the land lease, the existing shophouses were vacated and demolished.
2. **Design Risk:** Park Venture has a low design risk, because the LEED criteria were incorporated during the very beginning of the feasibility study. Palmer & Turner was hired based on the team experience in green development. A green consultant was hired to conduct an extensive environmental and energy research, as well as coordinate all the design and construction documents. Additionally, an in-house sustainability specialist provided an extra eye on quality and costs assurances. Consequently, the development team of generalists were able to lower the design risk by collaborating with experienced and specialized consultants.
3. **Construction Risk:** Because Park Ventures has a well-defined scope of work, budget, and timeline, the construction risk due to LEED certification was fairly low. The conventional delivery method and contractual forms were used in this case as the project management was fairly strong.

Organization architecture Suggestion

To deliver the first LEED platinum mixed-use development in Thailand, Park Ventures mandated a clearly defined goal cultivated by a small autonomous development team. Park Ventures' development team was focused on a single endeavor that led by a strong vision and a heavyweight managing director. Here, the organization structure fostered a collaborative environment through semi-quarterly gatherings that allow various teams to dissolve their "ego" through games and social events.

6.2 SCG 1, 2, 5 Renovation

Holding Company Overview

SCG, a leading business conglomerate in the ASEAN region followed a royal decree of King Rama VI to produce cement with diversified core businesses of cement-building materials, packaging, and chemicals. SCG is committed to conducting business in line with good corporate governance and sustainable development principles over 100 years. Therefore, achieving the LEED certification at SCG workspace is the first step to moving toward a sustainable value. With the goal of training in-house staffs for green construction, SCG 1,2, 5 renovation project is the first LEED EBOM in the ASEAN to achieve platinum level. The SCG headquarters reflect the identity of SCG under the three development framework toward

sustainability, encompassing economic, social, and environmental aspect. SCG 1, 2, 5 renovation project, and 100th year building are demonstrations of SCG's determination to propel society and provide construction materials that are truly sustainable like the way they conduct and business.

Development Process

The conceptual idea for renovating the headquarters took place for many years. The project finally got approved to move forward by the end of 2008. SCG transferred in-house engineers and architects from other departments to this particular development team to work as a single autonomous team. Green consultant, Dr. Jatuwan, the first LEED AP in Thailand was hired during the feasibility study. Most of the consultants were selected based on established relationships with SCG. After conducting feasibility study, the project began construction in 2010 and finished construction in 2011.

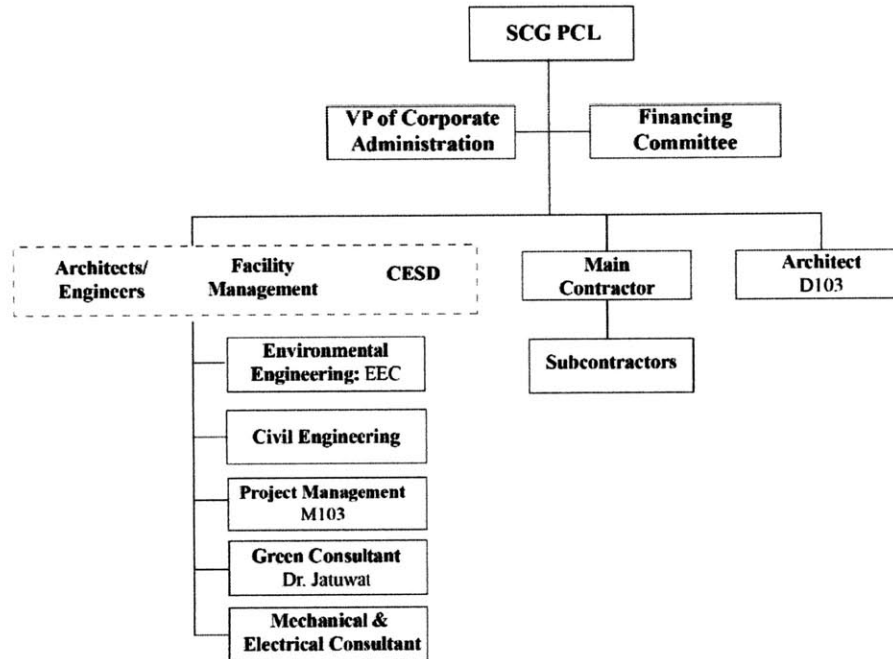
Delivering

A general contractor method was employed to provide tSCG with construction expertise for the team first development project. The construction contracts were on a lump sum basis. The design phase contracts for consultants were on a time and materials basis. The combination of these mechanism placed much of the risk of project on the developer. SCG 1,2,5 project differs from the Park Ventures in a number of important ways. Most significant is the size of the development company. SCG is larger and their timeline is much tighter.

Project Team structure & Delivery Method: SCG has an autonomous team structure where individuals from different disciplines are assigned to one project team. As a whole, the team members are dedicated to one task and are free to propose their own organizational structure, while remaining independent from the rest of the larger company. The SCG development team is comprised of Green Building solutions, SECD team, and Facility Management. Here, the selected engineering and construction consultants were directed by the autonomous team members. The development team is focused on results and objectives of the project, creating an entrepreneurial culture which allow each team members to explore new ideas through combining various expertise. Each team provides input in their area of expertise for every project.

Team Selection: SCG selected D103 to develop the master plan, and C103 to perform the site and civil engineering. The consulting firms again were selected based on their existing long relationship with SCG. Existing relationships often guide SCG's decisions, where SCG would approached a particular company for a discrete scope of work and negotiated a contract. There was also a competitive bid process to determine the most appropriate, skilled, and low cost firm for the construction.

Figure 18: SCG 1, 2, 5 Renovation Organization Structure



Notes: Figure 18 demonstrates the project organization chart gathered from a series of structured interviews, showing contractual relationship with different parties. The dashed lines at contractor indicate contracting with the subcontractors. The development team is encompassed by a dashed rectangle, indicating a shared responsibility and cross multi-disciplinary of each team members.

Contract: The LEED consultants were paid on a time and materials basis for energy analysis. The site, and civil engineers, and facility management engineer were done in-house. The environmental, and mechanical and electrical were paid on a lump sum basis. Here, SCG was able to shift some of the design and innovation risk on the consultants because of the dominance of lump sum contracts. C103, also agreed to a lump sum contract, the bulk of which covered the design charrette. By having engineers in-house, SCG was able to further control costs. The design and engineer staffs performs the bulk of site work under a fixed salary. A clearly defined lump sum contract allowed SCG to manage the project costs, budgeting, and schedules without sacrificing expert design consultation by splitting design responsibilities between in-house staff and consultants. The design risk is distributed to both the developer and the consultant. But it is significantly diminished with the selection of consultants experienced in novel products.

Risk Allocation

- **Regulatory Risk:** SCG's regulatory experience was very low because the project faced little opposition from the community. The existing land parcel was used to renovate projects, thereby requiring no rezoning or permitting. Again, LEED certification did not impose extra regulatory risk to the project.
- **Design Risk:** SCG's design risk was quite high because of inexperienced designers and energy conservation researchers. But the development team were able to mitigate design risk by bringing in consultants with previous experiences and specific skills relevant to a particular LEED criterion. The project director further controlled the design risk by assembling an in-house staff that had broad experience with design, construction, and energy conservation. The combination of generalists and specialized consultants hedged the project against design risk.
- **Construction Risk:** SCG's construction was quite high again because of constant changes, and lack of experiences for many consultants and in-house staffs. However, a strong relationship with the consultants allowed SCG to renegotiate work scope, budget, and delivery schedule to ensure good product quality and work efficiency.

Organization Architecture and Innovation

SCG 1,2,5 represents a green office building where innovative idea could and often come from the director. Because of knowledgeable in-house staffs, the development team was able to learn about green construction in an efficient manner, allowing for SCG to achieve expected returns on the headquarters. Although much responsibility is allocated to the consultant, the developer bore most risk that the final product would not garner expected returns. This allocation of risk was appropriate because the developer focused on both the product and process innovations.

6.3 SCG 100th Year Building

Holding Company Overview

The SCG 100th year building was developed based on the same mentality as SCG 1, 2, 5 renovation project.

Development Process

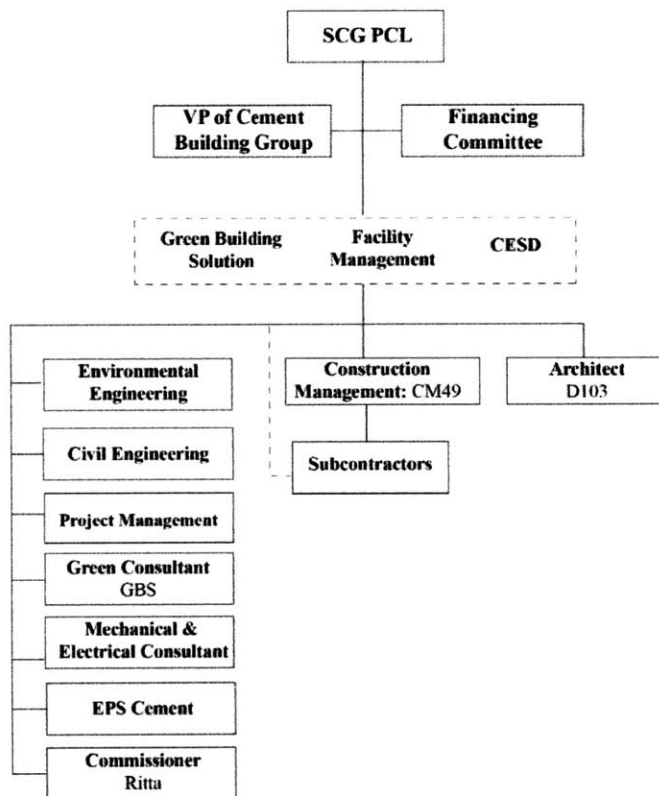
The idea inception stage for this project began in 1996-1997. But project construction was put to a halt during the Asian's financial crisis. Although the piling was put into places, design modifications were required as SCG began to reconsider building the SCG 100th year building again. When SCG decided to

add LEED platinum as part of the building criteria, extensive feasibility studies were done. When there was enough demand during 2011/10, SCG financial committee approved the 100th year building plan. Having constructed SCG renovation project, SCG development team were more experienced than before. Green Building Solution was established as their portfolio on green buildings expanded. The project must be finished within 25 months. This was a very tight project schedule for construction, thereby resulting in constant changes of design and construction documents during the construction. Consequently, a construction management firm was hired to oversee both the design and construction of the project. SCG hired GBS in US with the goal of learning international standards in conducting energy studies.

Delivering

Construction Manager was hired to coordinate design and construction of the project. The CM was supervised by SCG's development team which had an autonomous organization structure.

Figure 19: SCG 100th Year Building Organization Structure



Notes: Figure 19 demonstrates the project organization chart gathered from a series of structured interviews, showing contractual relationship with different parties. The dashed lines at contractor indicate contracting with the subcontractors. The development team is encompassed by a dashed rectangle, indicating a shared responsibility and cross multi-disciplinary of each team members.

Project Team structure & Delivery Method: SCG's development team in this project embraced the autonomous culture of discarding the standard organizational rules. The team structures were very similar to that of SCG renovation project. But the team members were able to complete this project in an efficient and more organized way than in their previous development project. The team assumed a heavyweight manager because the design and engineering consultants remain in their functional silos with project leadership. Again, like in the first SCG's green development, this culture of open exploration and strong leadership had created an ideal environment for innovation.

Team Selection: The consultants were typically selected based on the reputation of the company and existing relationships with SCG. There was a competitive bidding for construction. Because the project's green construction is innovative and an integral component of the master plan, the engineering firms played an instrumental role helping SCG realize their sustainability goals.

Contracts: The consultants were negotiated on a time and materials basis where the consultants assumed no risk in the pricing and delivery of their services. The scope of work of this project was largely undefined. Consequently, over time the scope of work grew but the contracts were never updated. This suggests that the actual contracts were not important to SCG 100th in defining the consultant's scope of work, shifting risk. Rather, SCG relied on the basis time and materials payment structure and an informal relationship to guide the relationships with consultants. From a contractual perspective, this approach was not sophisticated, but it allowed the flexibility for changing work scope, which was facilitated by the time and material arrangement.

Risk Allocation

- Regulatory Risk: no risks due to LEED certification.
- Design Risk: SCG 100th year building experienced high design risk because the project was constructed as the design and construction documents were still executed. But due to the consulting firms' willingness to accept the inherent risk because of trust they had with SCG, the consultants were willing to extend leniency to SCG.
- Construction Risk: SCG was able to limit the construction risk by hiring construction manager, a trust and experienced CM to manage the design and construction to ensure that the work was completed according to the unique vision of SCG. With more experienced in-house workforce, SCG further mitigated construction risks through implanting more trainings and extensive researches on value creation in green construction.

Organization Architecture and Innovation

The lean autonomous structure of the development team with a heavyweight manager encouraged product innovation at SCG. Through on the job design and extensive subcontractor and in-house staffs training and oversight, SCG found new ways to envision and execute the holding company's sustainability vision. To conceive innovation efficiently, the development unit was structured to be small and diverse with the goal of encouraging creativity and exploring new and efficient ways of executing.

6.4 Ritta HQ

Holding Company and Project Overview

Ritta Company Limited is a design-build construction company in Thailand that has designed and built large department stores, condominiums, infrastructures, factories, and hospitals. Ritta portfolio is worth more than five hundred billion baht.⁴⁹

In 2005, Ritta began stocking up land banks for logistics, fabrication factory, sport competition center, as well as headquarters. Ritta new headquarter, a 4-storeys clear green glasses with a big central atrium is located at the motorway near [Suvarnabhumi] Airport. It is the first building that received LEED Gold for New Construction in Thailand. By achieving LEED gold certification, Ritta is able to build its own green portfolio and train the team for green construction to international standards. Similar to SCG case, after Ritta HQ was completed, Ritta established its subsidiary company called Thai Global Energy which provides a turnkey solution for solar power plants and green constructions.

Development Process

The project idea conception began in 2005, during the period of expanding Ritta's land bank. Since 2007, Ritta had begun conducting series of feasibility studies for 10 months with the goal of designing an energy efficient office building. In-house engineers and designers were responsible for design, construction, and operation. Right before construction, Ritta's director decided to include LEED gold certification criteria into the project. Consequently, the teams had to work together to modify and produce drawings, and project execution plan to incorporate LEED criteria. Consultants were hired during later stages of construction because of Ritta's extensive experience in construction. Almost all of the works

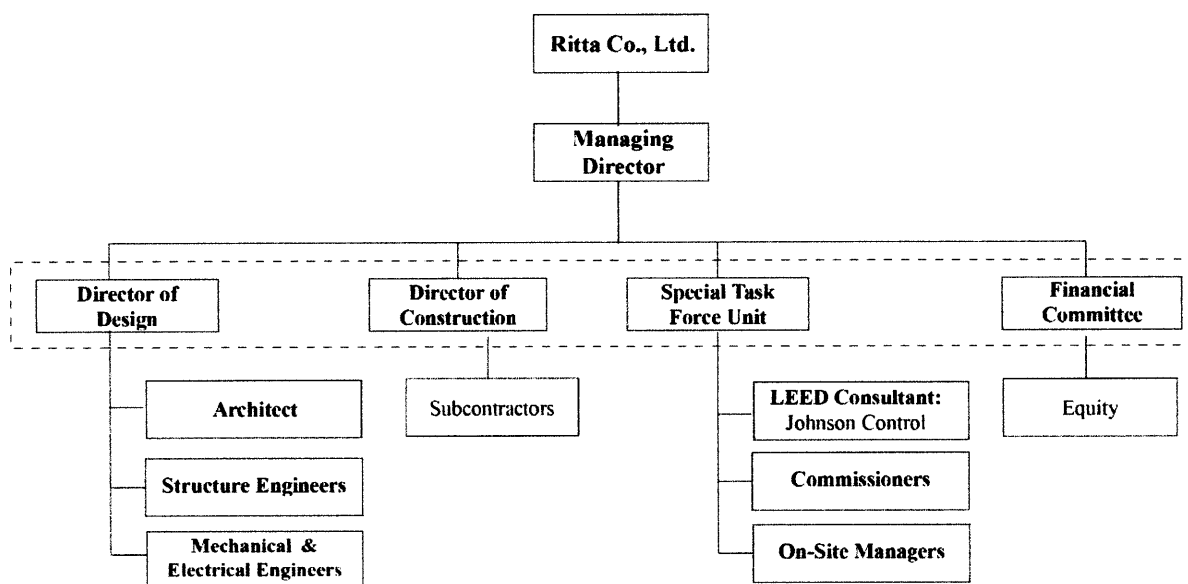
⁴⁹ Ritta.com

were done in-house and on the job training. The project finished construction in early 2011. Commissioning took about 2-3 months.

Delivering

The construction of Ritta was performed through a multiple primes delivery method where all members of the construction team were contracted directly with the developer. The design phase was implemented by in-house workforce. This delivery mechanism placed much of the risk on Ritta. But because Ritta is experienced in construction and design business, Ritta was able to control the costs and ensure product quality. The integrated management techniques were done with in-house staffs, and construction works were further subcontracted.

Figure 20: Ritta Headquarter’s Organization Structure



Notes: Figure 20 demonstrates the project organization chart gathered from a series of structured interviews, showing contractual relationship with different parties. The dashed lines at contractor indicate contracting with the subcontractors. The development team is encompassed by a dashed rectangle, indicating a shared responsibility and cross multi-disciplinary of each team members.

Project Team structure & Delivery Method: Ultimately, Ritta managed and directed the works of all design, consultants, and subcontractors. The director of construction directed various subcontractors whose work is directly contracted with Ritta. This type of team has a high entrepreneurial spirit through employing an autonomous specialized taskforce unit to coordinate the LEED criteria into every process of the project. Therefore, although the design and construction teams were organized as a functional team,

where expertise from various department worked on only a specific task on the project, each teams was able to collaborate across disciplines in a timely manner. This type of organization structure, as illustrated in *Figure 21*, allow Ritta to easily control the project budget, timeline, and scope.

Team Selection: Ritta based the consultant selections primarily on existing relationships. This demonstrated the importance of long-term relationships. Existing relationships in construction industry often guide their decisions to hire firms. The selection process for construction professionals was typically done through competitive bidding process where qualifications and price were important, but secondary to existing relationships with Ritta. A combination of these methods allowed the developer to get the specialized skill and quality the firm sought as well as competitive driven price in green construction.

Contract: Because Ritta cultivated a cohort of trained contractors and engineers who bid against each other, the firm was able to paid commodity prices for the project, although the headquarter is a green specialized product that required specialized workforce. Some construction professionals were also negotiated on a cost plus fee basis for a particular scope of work. Here, the cost plus fee contracts and time and materials were appropriately used during construction to provide project flexibility to Ritta. Through a unique combination of selection methods and contractual forms, the developer reduced his exposure to cost and schedule risks during construction without compromising the quality of work.

Risk Allocation

- Regulatory Risk: The regulatory risk is low because there were no extra land permitting process required from certifying the project with LEED gold.
- Design Risk: Ritta assumed a high design risk because there were little outside specialized consultants. But the firm was able to minimize the risk through its experience and innovative process of collaboration. From this, the firm was able to hedge against the design risk.
- Construction Risk: Ritta reduced the construction risk by hiring a trustworthy and experienced Director of Construction to manage the office development, thereby ensuring the work was completed according to the vision of Ritta. The firm further mitigated the risk by hiring subcontractors who Ritta was familiar with, and conducted detailed on the job trainings.

Organization Architecture and Innovation

Ritta's new headquarter highlights the importance of process innovation. The multiple prime method allocated almost all the risk to Ritta. This way, Ritta did not have to pay a risk premium, thereby keeping the project flexible and lowering the costs by managing the construction process themselves through a multiple prime method. The process innovation observed in this project was extensive because of the specialized unit that was set up by Ritta for collaborating LEED documentation across various teams with each phase. The delivery mechanisms did not require a strictly defined scope of work for the consultants, therefore increasing the flexibility necessary for Ritta to invent, design, and construct to accommodate for modifications due to LEED criteria.

Chapter Seven

Synthesis of Case Studies

This chapter synthesizes the case study investigation to identify key problems of the existing green project management. This chapter finds that adding green certification criteria to the development process exaggerate the existing sources of risk in the development process. Project delivery methods, contractual forms, and organization structures may help control and shift associated risk in green developments. The chapter also suggests that although conventional delivery methods and contractual forms were used in every case, there are two fundamental modifications to the current development model. Firstly, the specific provisions should be modified to accommodate for the changes in the project scope which often come with green development. Overhead and fee bid can be used with open-book subcontracting process. This is because open-books allow the developer and owner to access the pricing and estimates of the subcontractors. The contracts can contain performance, incentives, and bonuses provisions for green projects to achieve the sustainable vision for the company. Similarly, informal contracts and reputation and relationship plays a crucial role in solving the agency issues present in team members and consultants. Here, the power of reputation within the local industry is an effective tool in promoting contractual agreements, and accommodating constant changes in the project scope. Secondly, a well prepared project management is critical in delivering a successful cost-efficient green office building. Through the case study synthesis, the thesis presents four specific approaches to traditional project management practices: start green projects with an end goal, project team integration, bonus systems, and training during construction. The proposed modifications and approaches to the conventional development model are further discussed in Chapter Eight.

7.0 Green development Practices and Innovation Processes

When developing a product innovation in Thailand's green market, the process of delivering may need to be modified in order to realize a new product. The case studies show that there is an incremental process innovation that comes with green development. Process innovation refers to new ways of approaching and manufacturing a product. Here, product innovation in Thai's green market often mandates process innovation. Each case employed more meetings and hired more consultants than conventional office projects with the goal of ensuring extensive environmental investigations and meeting LEED standards. For instance, there is a specialized unit within the Ritta HQ's development team to coordinate LEED criteria with all the team members during design and construction. The differences between green project management and that in conventional practices represent new important alterations to the typical project management process in delivering successful cost-efficient green office buildings.

The case studies illustrate modification samples which include more construction oversight, greater subcontractor education, and construction regulation. The subcontractors in each case implements on-the-job training and education. For instance, in delivering Park Ventures, semi-quarterly meetings and “ego-dissolver” activities must be implemented. The managing director suggested that because the Park Ventures’ teams were building an important green office landmark of Thailand, extra communication and collaboration skillsets are required, without ego and a fixed-mind-set. In another words, the team members had to learn how to wear different hats. Similarly, Energy Complex used two general contractors within one master plan because of its large scale. To maneuver different components, the subcontractors were needed to be met frequently with the development team. Moreover, the learning process during SCG construction were very efficient. Here, the flexibility in the learning process created an entrepreneurial environment for the development team. The team members hired international firms so that they could learn international techniques for extensive environmental investigations. Learning from their experiences, the development team members of SCG 1, 2, 5 renovation projects later on formed a new specialized department for green construction under the larger organization of SCG.

In the process of realizing innovation in green office development projects, there is a series of incremental adjustments made to the different types and degree of innovations occur differently. *Table 2* breaks down the green motivations and practices for each case. In green office development, during the design phase, there is a significant product innovation. However, during the construction phase, the process innovation level increases in the form of training and construction oversight. For instance, the delayed decision makings in the Energy Complex development process mandated a high process innovation where the development team must form a new team structure and communication methods between subcontractors to deliver the project under budget and on time. As illustrated in *Table 2*, the Energy Complex is categorized as a high level both in a product and process innovation.

Similarly, as part of the marketing strategy at Park Ventures, design and development to LEED CS, platinum standards have been strongly reinforced. Park Ventures represent a moderate process innovation level, but high level of product innovation because the project did not require complex organization team to deliver the project. This is because the project sustainability goals were well established since the beginning, ensuring that the integration of specialized consultants were done in a timely manner. Consequently, the high level product innovation of Park Ventures can be achieved through a moderate level of process innovation.

Table 2: Green Development Motivators and Performances Overview

<i>Case Study</i>	<i>Parent's Organization</i>	<i>Green Driver</i>	<i>LEED Certification Type</i>	<i>LEED Certification Level</i>	<i>Process Innovation Level</i>	<i>Product Innovation Level</i>
<i>The Energy Complex</i>	<i>PTT/ Ministry of Energy</i>	<i>Environmental Commitment</i>	<i>Core + Shell 2009</i>	<i>Platinum</i>	<i>High</i>	<i>High</i>
<i>The Park Ventures</i>	<i>Chemical Manufacturer/ Residential Development</i>	<i>Marketing Strategy</i>	<i>Core + Shell 2009</i>	<i>Platinum</i>	<i>Medium</i>	<i>High</i>
<i>SCG 1, 2, 5</i>	<i>Construction material provider</i>	<i>CSR</i>	<i>EB: OM 2009</i>	<i>Platinum</i>	<i>High</i>	<i>Medium</i>
<i>SCG 100th Year</i>	<i>Construction material provider</i>	<i>CSR</i>	<i>New Construction</i>	<i>Platinum</i>	<i>Moderate</i>	<i>High</i>
<i>Ritta Headquarters</i>	<i>Construction and Design</i>	<i>Environmental Commitment /Knowledge</i>	<i>New Construction</i>	<i>Gold</i>	<i>High</i>	<i>Medium</i>

Notes: Table 2 breaks down the green development origins by the holding company type, green driver, LEED certification type, and LEED certification level. The innovation performance level in green market is evaluated based on process and product innovation level. The two innovation performance levels in each case study are evaluated based on their green certified level, organization structure, delivery methods, and development timeline. A process innovation level indicates the development team's effectiveness to cultivate ideas, fosters ownership, and ultimately conceive and deliver desired green certified development. The product innovation level is based on the LEED certification level: Platinum certified project refers to high product innovation, and Gold certified project is a building with medium product innovation level.

Furthermore, the case study analysis has illustrated that the idea of developing green office buildings by certifying the projects with LEED labels was motivated by marketing and branding agenda, as shown in *Table 2*. For instance, the managing director of Energy Complex included an energy-efficient goal by incorporating LEED with the goal of creating an universal branding solution for all energy provider corporations in Thailand. Likewise, the renovation and construction of SCG headquarters have been reinforced by the four main sustainability principal of the larger SCG's organization. Ritta, as a construction company, wanted to develop a project that is energy efficient and LEED certified, as a way to promote its sustainability reputation and learn new techniques of green construction from developing its own project.

With an understanding of the green certified project motivation, the thesis can illustrate a framework for incorporating new green office products to compliment the overall vision of the organization. Moreover, this framework lays out a strong foundation for further product and process innovations in green commercial office industry.

7.1 Team Structures for innovation.

When a green product is pursued voluntarily and independently in the private sector, the development company often gains experience and knowledge fairly rapidly. The high learning curve obtained from the private sector encourages radical and systematic innovations than those undergoing environmental

innovation regulated by the government, which often resulted in a minimal innovation. These cases advocates that the private sectors are crucial in advancing innovation in the green market, while the government regulations leave little faith for the private sector to appreciate their environmental benefits due to administration instability. The case studies used in this thesis also play a crucial role in public education about the challenges and benefits of innovation and the optimal delivery methods used for each types of organization structures. Similarly, these cases illustrate common aspects in facilitating innovation, and differences that could create additional barriers to green innovation.

Table 3: Team Structure Overview

Case Studies	Development Team Structure	Innovation Ability
<i>The Energy Complex</i>	Functional	Medium
<i>The Park Ventures</i>	Autonomous	High
<i>SCG 1, 2, 5</i>	Autonomous	High
<i>SCG 100th Year</i>	Autonomous	Medium
<i>Ritta Headquarters</i>	Functional	High

Notes: Table 3 highlights the organization of the development team in each case, and their innovation ability given the team structure and development timeline. Innovation level indicates the development team’s effectiveness to cultivate ideas, fosters ownership, and ultimately conceive and deliver desired green certified development. The high ability in innovation refers to their high capability to deliver the project based on the development team structure within a timely manner and appropriate budget. The medium ability depicts a moderate capability to deliver the project.

Team Structure: Ranging from six to ten staff, the development teams in each cases were interdisciplinary and small with design, engineering, public policy, and construction background. The small team allows for an efficient communication, and specialists of various disciplines to cultivate ideas together. The effectiveness of such team structure is evident in the case of SCG and Ritta where the architects, and engineers were the masterminds in creating a product and process innovation of green development by working across disciplines, and coordinating and learning the LEED criteria.

Energy Complex and SCG 100th year building are projects that have heavyweight structure at the holding company level. The two organizations transferred non-specialists in real estate to work on the particular green project. The Energy Complex and SCG 100th, which are large company have a functional and autonomous team structure at the project level, respectively. The development teams are consisted of less than 8 people who were working on multiple projects. The functional team structure of Energy Complex could undermine the ability to innovation, as shown in *Table 3* by diving up the staffs’ attention and responsibilities, and thus the feelings of ownership. Conversely, the development team of the Park Ventures and SCG 100th year building, each has an autonomous team structure that fosters ownership among the development staffs and ultimately innovation. Here, as illustrated in *Table 3*, the Park Ventures and SCG 100th year building project both have high ability to innovate because the development team

structures were organized such that each members were able to conceive and implement innovation effectively.

Ultimately, while each types of team structures can facilitate different degree of innovation, the analysis of the selected case studies has revealed that the culture and leadership styles are crucial in generating an entrepreneurial spirit and sense of ownership. The leadership level of the managers can set a strong foundation for green project management methodology that encourages a culture of integration and overcomes challenges.

7.2 Risk Mitigation in innovation

The case studies analysis illustrates that implementing to LEED standards create additional risk or uncertainty in each phases of the development processes, taking the project team structure, scope, and timeline into considerations.

Table 4: Project Delivery Methods and Contractual Forms in Design and Construction Phases

Case Studies	Project Delivery Method	DESIGN		CONSTRUCTION	
		Selection Method	Contractual Form	Selection Method	Contractual Form
<i>The Energy Complex</i>	General Contractor	Bidding	Lump Sum	Bidding	Lump Sum
<i>The Park Ventures</i>	General Contractor	Relationship	Lump Sum, time+material	Bidding	Lump Sum
<i>SCG 1, 2, 5</i>	General Contractor	Relationship	Time + material	Relationship	Lump Sum
<i>SCG 100th Year</i>	Construction Management	Bidding	Lump Sum	Bidding	Cost Plus, time+material
<i>Ritta Headquarter</i>	Multiple-Primes	In-House	Salary	In-House, bidding	Cost Plus Fee

Notes: Table 1 breaks down the project delivery methods, and the typical contract types used in design and construction phases for each case studies. Contractual Forms: Lump Sum is used when the contractor agrees to perform the stipulated work in exchange for a fixed sum of money. It commonly includes all labor, materials, project overhead, company overhead, and profit. Cost-Plus is used when contractor is reimbursed the cost of doing the work, including labor, materials, and project overhead, plus a fee, including company overhead and profit. Time and and material contract form is used when a contractor agrees to be paid a set cost per unit of item or time. It typically includes all labor, materials, project overhead, and profit. The actual total amount paid is based on the actual measured units spent on the project, times the unit price agreed to. Selection Methods: Bidding refers to a competitive bid process where a contractor is selected by the lowest price proposal in market competition. Relationship refers to a negotiation type process where the price and the contractor are selected by negotiation between the owner and the contractor based on relationship, and reputation.⁵⁰ In-House describes an employment of in-house employees paid by monthly salary to work on the project.

Based on the project delivery methods and contractual types negotiated in each projects, the green developments of Energy Complex and SCG incurred greater risks than in the developments of Ritta, and Park Venture. In response, the developers have formulated several mechanisms to shift and mitigate these risks.

⁵⁰ “Constructability of Construction Contracting Methods with Projects and Owners” M.S. Thesis Massachusetts Institute of Technology. 1991. Figure 1. p.10

Project Delivery Method

The multiple prime method was used to deliver Ritta's headquarter. Here, all the design and construction were executed by in-house staffs and additional consultants who were contracted directly with Ritta. This method allows Ritta to better control the process and potential savings. However, it also required Ritta to assume much more risk, which also incentivized Ritta to manage the project well to deliver a success office product.

The Energy Complex, Park Ventures, and SCG renovation project, each employed a general contractor method to shift construction risk from the developer onto the GC. This is particularly appropriate for the three projects because the holding companies of these three cases did not have significant design and construction expertise on green construction. The general contractor arrangement not only transfers risks to the construction company, but also transfers incentives in the form of greater premiums which is typically attached to lump sum contracts to control realized savings.⁵¹ SCG used a construction management method for the SCG 100th year headquarter project. This method was appropriate for a very tight timeframe project where SCG's development team only had a year and a haft to complete the project. Construction management method allowed SCG to design and construct the project simultaneously to accommodate the project tight schedule. Consequently, informal lump sum contracts were typically used to provide for constant change orders while allocating the increased costs to the developer to deliver the project successfully.

Contracts

Time and material contract were used with the green consultants in each cases. This type of contract can increase the risk to the developer because an innovative green product demands more project management, and often mandates constant changes of work scope during both design and construction phase. Consequently, time and material contract may add to the cost risk in a longer approval projects with constant changes scope of work. But given that the scope of work in each cases were undefined and difficult to control, time and material are appropriate.

Most of the cases employed lump sum construction contracts to shift the cost risk to the subcontractors as the project scope became more clearly defined. For each case, the construction company reduces the risk in a lump sum contract by mandating the developers to pay a premium, thereby resulting in a higher cost

⁵¹ "Constructability of Construction Contracting Methods with Projects and Owners" M.S. Thesis Massachusetts Institute of Technology. 1991.

to the developers. The development teams in each cases used in-house engineers to guide the work of outside consultants as the scope of work changes constantly from poor project management and unexpected events.

Various types of delivery methods and contracts for different organization structure can mitigate risks in each phases of the development process. As shown in *Table 5*, adding LEED criteria did not present additional risks during the regulatory and approval phases. During the design and construction phases are where adding LEED criteria increased the risk premium in the contractual price. For instance, there were many late changes due to the staffs' lack of experiences and good planning. In many cases, important decisions were made after construction documents were already produced, and piling already had begun, thereby resulting in redrawing of design and construction documents. The consistent changes prominent in most cases resulted in many delays and difficult cost control. With an advance preparation like in the case of Park Ventures, there is a low design risk because specialized consultants were involved in a timely manner to collaborate ideas and work toward the same vision.

Table 5: Risk to Developer from Green Development using above Delivery Methods and Contracts

Case Studies	Regulation	Design	Construction
<i>The Energy Complex</i>	Low	Low	High
<i>The Park Ventures</i>	Low	Low	Low
<i>SCG 1, 2, 5</i>	Low	High	High
<i>SCG 100th Year</i>	Low	Low	Low
<i>Ritta Headquarters</i>	Low	High	Low

Notes: Table 5 breaks down the level of risk that the developers faced for each phases by three major types: regulation, design, and construction. The high and low represents a qualitative level of the uncertainty. Regulation risk level refers to the degree of exposure to the unknowns, and cost and time associated with the process of green development during land permitting and rezoning. For instance, a low regulatory risk means, there is almost no risk involved in the process of land permitting. Design risk level refers to the unknown, and cost and time associated in green development during designing the product. High design risk level refers to high uncertainty, cost and time involved in getting the desired product. Construction risk level refers to the unknowns and cost and time associated with the process of green development during construction. High construction risks represent construction delays, and limited control over budget and quality of the green product.

Construction phase is typically the least risky phase to the developer. But because the subcontractors were new to green developments, construction risks increased significantly. To navigate through the barriers and meet the educational gaps, projects must be well planned since the beginning while using appropriate delivery methods for different organization structures. During the execution of Energy Complex, the construction risks were passed onto the engineers and general contractors. In Park Ventures, the construction risks were small because of a carefully timed decision making process, and an appropriate delivery method. SCG 1, 2, 5 renovation project had a high construction risk because this is their first green construction project for both their in-house engineers as well as the contractors. There were many

delays but also a steep learning curve which lower the construction risks in SCG's second green development project, SCG 100th year building, because the team were more experienced in green construction management and hired a construction management team to shift construction risk to the contractors. Meanwhile, in-house staffs were employed to construct the LEED certified Ritta Headquarter through on the job training. This could be a very risky phase of Ritta, but because the company is an experienced design-build construction company, the project was able to be delivered on time and under budget.

7.3 Risk Allocation Suggestion

Depending on the particulars of the project, the appropriate delivery method is determined. For instance, a multiple primes delivery method seems appropriate for Ritta because their holding company is a design-building construction company that have available workforce appropriate for green construction. Consequently, the project did not require much dedication on finding the suitable workforce, but the project required extra layer of project management to communicate within each team to ensure that the LEED criteria are met in each phase. Additionally, past relationships with consultants and contractors are employed in every cases to hedge against the development risks.

Although the cases vary in delivery methods and organization structure, the contractual types negotiated were very similar. The cases relied on industry relationships, informal contracts, incentives, and penalties to establish and regulate the relationships between the developer, and design and construction professionals. While informal selection processes and contracts can help mitigate risk, such as agency problems, they can also allocate more risk to developer. By choosing consultants with no prior experience, the developers introduce risks to the project. Conversely, appropriate construction firms were always selected based on their reputation and specialization to deliver the project on time and within appropriate budget when most construction firms have almost no experience in green development.

Time and material, and lump sum contracts have challenges and benefits. The time and material contracts allow the developer large control, while lump sum contracts establish price premium and security, but can create agency problems in which the consultants shift the risks to developer and cut corners to preserve the fee. Given the industry culture, lump sum and informal contracts have been negotiated so that multiple modified contracts could be made as the project scope and timelines changes.

The industry has yet to employ a more appropriate contracting method that combine the benefits of both contract types, which is a guaranteed maximum price for the contract. In GMP, the contractor is compensated for actual costs, and worked billed on a time and materials basis up to the pre-determined ceiling price after which point any further costs are entirely or partially absorbed by the consultant. The contract should include incentives that encourage the consultant to create savings, such as saving-sharing provision were contractors receive a percentage of any savings they realized. This type of contract requires inexperienced consultants to absorb the educational cost of learning a new design form under LEED criteria. If there are change orders, the GMP will be increased as the result of additional scope. While such a contract would limit the cost risk to the developer, by providing the developer with some control over the work of the consultants and secured service price, However, this type of contract may not be appropriate for all green development projects because it limits the process exploration and reduces opportunities for innovation and creativity. But it significantly reduces the developer's risk without damaging innovation and quality of the project.

Chapter Eight

8.0 Recommendations for Green Development

This chapter takes the synthesis from Chapter 7 and develops an overarching framework for the team formation and construction management practices throughout the development process. This new procedure can reduce the cost of green construction through an early project management planning by mitigating regulation, design, and construction risks. Consequently, by utilizing this framework, the developers can increase rates of return, and control operating costs. The analysis findings of project delivery methods, contractual forms, and organization structure can be of an immediate use for green developers to control risks. To reduce the amount of reworks, idea conception and preconstruction phases can be the key to risk mitigation because they are stages in the development process which bring in various consultants into the project, and resolving the design to commence the project construction.

There are four major approaches to overcome major challenges in green construction and improve its financial success: an enhanced level of communication across the teams, an inclusive charrette process during the idea conception with stakeholders, and a careful and early project planning. Early project management planning and additional adjustments can accommodate for the increased needs in cross-disciplinary coordination within various organizational structures during design and construction. The traditional construction management methods often contain a linear and fragmented processes, and generate many reworks in the subsequent stages, as presented in Energy Complex, SCG 100th year building, and Ritta's HQ projects. Early adjustments to the project management methodology can create an integrated design and construction team that are able to work together throughout the development process to ensure the goals of green building construction are met in every phases. Based on interviews with prominent green building developers and three green consultants in Thailand, the case study analysis, and the review of Reed and Gordon's literature on building process, *Figure 21* presents specific adjustments for the team formation and construction management approaches in each development process. The graphical timeline depicts the conventional construction management approaches in white, and green construction management approaches in green with the goal of illustrating the differences in mindset and the new procedure of delivering green development. The conventional management approach encompasses the functional team structure effect. While, the green management approach mandates an integrated approach of cross functional and autonomous team, early planning and design, and more collaboration. The case study synthesis suggests that the most optimal development team structure that foster innovation and creative working environment is a small autonomous structure.

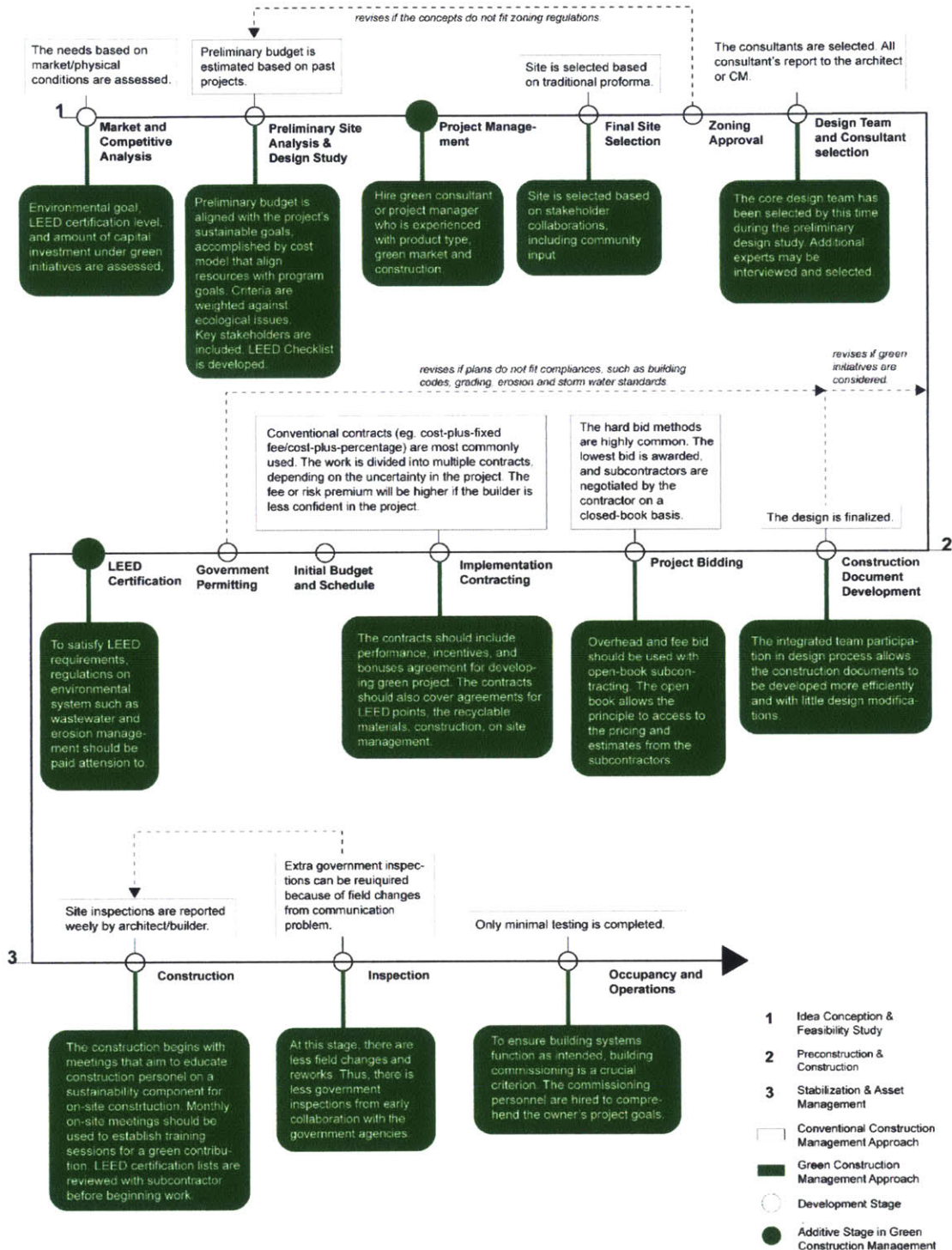
There are two additional stages to the development process for green construction:

- **Project Management:** In green construction, an experienced green project manager is hired to work with the development team, as well as with the other key consultants. However, in conventional construction, hiring a project manager doesn't happen until the design and construction documents are compiled.
- **LEED certification:** While documentation can be difficult to assemble from multiple teams for conventional construction, in green construction, the constant efforts from the project manager and green technology can make documentation more efficient for the project's schedule and budget.

Without early planning, there are four stages where most reworks occur during the development process:

- **Zoning approval:** Due to poor communication in conventional management, this is often the first time regulatory agencies have seen design concepts. This causes many reworks in feasibility stages if the design does not fit the zoning regulation. However, in green construction the zoning process often goes more smoothly because green development, such as Park Ventures, have to go through an extensive charrette process to encourage feedbacks from local governments well in advance.
- **Construction document:** Although the design is finalized by this time, this is where green initiatives are considered, causing many revisions on documents and team structures. For instance, the Energy Complex, and Ritta project decided to incorporate LEED rating systems after construction already begun. However, with green construction management approach, construction documents can be developed with little design modification because an integrated team structure has participated in the planning and design process.
- **Government Permitting:** Plans are often reviewed for the first time for engineering regulations, which may create delays. However, with green management approach, government stakeholders are involved at earlier stages to ensure compliance with local LEED requirements, such as storm water management as well as erosion and grading codes.
- **Inspection:** There are often field changes caused by poor communication between developer, architect, and contractor which can cause additional government inspection. This creates cost and schedule inefficiencies. However, in proposed green construction management approach, government regulators can work as partners because of their early involvement. This reduces amount of reworks for re-inspections.

Figure 21: Comparison of Conventional Construction and Green Construction



Notes: Figure 21 displays a development timeline that compares traditional construction approaches and green construction approaches to development Thailand green office buildings throughout various phases. The three horizontal lines represent three major groups of phases: (1) Idea Inception & Feasibility, (2) Preconstruction & Construction, (3) Stabilization & Operation. Each phase also goes through further stages. Each stage is highlighted with distinctive characteristics of a green construction approach, and a conventional construction approach.

The below suggestions revolve around the premise that a green project improves its chances for financial success if a cross-disciplinary team is involved at the earliest stages throughout the project. The benefits of the following approaches to green development are essential for the successful delivery of a cost-efficient green construction project. The four approaches are essential in overcoming a major challenge that has impacted development and construction in Thailand: fragmented functional experts who struggle with communicating and collaborating as a team. Therefore, the following approaches can be adopted early when pursuing green office construction to minimize construction and operational costs.

1. Start with an end goal: Specific sustainability goals and project priorities for green building features can be set before design and construction phases to deliver green projects within suitable financial parameters. By setting priorities within the project feasibility phase, the framework for all future project decisions can be established, and thus, reduce major modifications or change orders in later phases. The case study reveals that there were many late changes due to poor timing decisions in many of the cases. For instance, Ritta's HQ and Energy Complex developments, LEED criteria were decided to be incorporated after construction already begun, resulting in many field adjustments, delays, and budget increased. With an advance preparation, Park Ventures development was able to lower the design and construction risks, because specialized consultants were involved in a timely manner to collaborate ideas and work toward the same vision.
2. Development team integration: The project manager and main members of the development team are selected in the project's feasibility stage to ensure early on collaboration. The charrette is implemented early in the process. The project team members can also be brought into the designing of the project, initial price estimation and construction document development. The most challenging part in delivering a financially successful green project is communication, as LEED certification process is more complex than conventional projects. This increases the need for constant cross-disciplinary team coordination. The case study analysis illustrates that small autonomous development team allows for an efficient communication, and specialists to cultivate ideas together. For instance, Park Ventures and SCG 100th year building development teams both have autonomous team structure that foster ownership among the team members. However, assembling the team early for architects, contractors, and managers are not always cost-effective. Consequently, by hiring generalists with exposure to green development can have similar results with lower costs. In all of the cases, generalists were in-house employees who were able to perform many tasks necessary to move a project through predevelopment while also performing a

necessary expertise in particular area. The green generalists are often complemented by consultants who have more specific skills to perform defined scope of work. Therefore, this type of staffing can save costs because consultants are hired based on limited basis for an expertise on a specific area.

3. **Bonuses:** The cost plus fee arrangement can be used to promote efficiency by incorporating incentive and penalty systems. In hard bid method construction for conventional construction projects, contractors often add premiums for cost estimates to cover presumed risks, especially if LEED certified building mandates a LEED experience. The integrated project team is ideal for a green project because a contractor who understands the owner's vision is in the mix to participate in the design and cost estimation. The development team in each case incorporated in-house engineers to guide the work of outside consultants as the scope of work changes constantly from poor project management and decision timing. Given constant changes scope of work, time and material contract is an appropriate option, but may increase cost risk in a longer approval projects. Additionally, a cost-plus-fee arrangement can be used with an open-book subcontracting process, a number of bids for subcontracts, and specific provisions about project cost savings. With an open-book subcontracting, the owner can have access to the pricing submitted by subcontractors. Within each case, informal lump sum, and time and material contracts were used to accommodate for late change orders during construction. The cases relied on industry relationships, informal contracts, incentives, and penalties to establish and regulate the relationships between the developer, and design and construction professionals. While informal selection processes and contracts can help mitigate risk, such as agency problems, they can also allocate more risk to developer.
4. **Training during construction:** Start-off and monthly meetings can be conducted on-site with the inclusion of sustainable education in the sessions component. A project management software system is crucial in tracking documentation for LEED certification, project budget, schedule, and personnel. The subcontractors in each cases implemented on-the job training and education. For instance, in delivery Park Ventures, semi-quarterly meetings were implemented after commencing construction. Similarly, Energy Complex used two general contractors to maneuver different components by setting up daily and weekly meetings among the development team members and subcontractors.

8.1 Challenges and Opportunities for Real Estate Stakeholders

In Thailand, the demand for green building from clients is indeed one of the main drivers in green construction industry. Superior building performance, tenant satisfaction and productivity are also the main drivers for implementing green office construction. Meanwhile, the most important factors that affect the implementation of green construction are a lack of education and awareness. Although, in Thailand the awareness of building green is increasing, the LEED certification concept in office construction industry are still new to major stakeholders to implement them.

There are initiatives to motivate the new trend of green office building. But the potentially higher upfront costs of green building have overshadowed the benefits of green construction. Although Thai government have launched incentives to promote green buildings such as government collaborating with leading commercial banks to finance energy conservation and renewable energy projects, or the FAR bonus initiatives with TREES, the discontinuity of policies have made it challenging for office developers to be fully confident in the government support. No substantial commitments have been made with regards to TREES and LEED certified buildings. Therefore, the organizations in private sectors often have new policy that do not rely on the government's support.

Despite of the push from private sector, the adoption rate of green building remains relatively low compared to developed countries. However, going forward, the green construction industry is increasing and provides huge opportunity to both local and foreign investors despite multiple challenges in the process. Green building trends will continue to be limited to commercial buildings. Green costs will decrease gradually as there are more solutions and skilled workforce in the marketplace. There thus needs to be a first step from industrial players who are the major drivers of changing Thailand's regulatory framework in the green institutional real estate market. To efficiently lobby the policy makers, industrial players should work together to create collective ideas for regulation changes. Such groups will be a driving force for green building development in Thailand.

8.2 Areas for Further Research

Scope and Limitation of the Case Study

The case studies are analyzed from the individuals specific' insight which is can be highly biased. The development team, and company portfolio vary in experience and scale. Each case study also has different amenity packages, target different and overlapping demographic groups and developers. The vast differences can create extra hurdles in concluding lessons learnt about the risk allocations and project

management. But, such differences also allow relationships among green innovation, structures, and development processes to be investigated for unexpected insights for more thorough study. Moreover, development projects that are certified with LEED/TREES/Green Mark rating systems are described in short as “green” buildings.

Future Research Directions

The analysis of green developments and its innovation origins, organization architecture, project delivery methods, and contractual forms is investigated through multiple parameters— from a general understanding of the motivators for innovation and team structure to the narrow view in comprehending the project delivery methods and contractual forms. The case studies in this thesis provide a great opportunity to evaluate how the competitive bidding and firm selection affect risk allocations, although in the end, each firm negotiates conventional and informal contracts. Because larger public firms are more concerned with cost, liability, and risk, extra negotiation with consultants and contractors were made. While there are researches on performance and cost of green office projects, there are no case studies about the project management and integrated team approaches applied to the cases. Thus, further studies on such development model being applied to actual case is a great start through retrofitting model. Further research on this topic will help determine if the recommendations for green project would benefit the traditional construction projects.

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