

An Approach to Prioritizing the Commercial Real Estate Development Risk

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Abstract

After 30 years of war in Sri Lanka, the demand for real estate has increased tremendously across the nation. Similarly, numerous real estate sub-sectors have avidly participated in the worldwide boom. However, with failures and poor functioning of many investment projects, the industry's risk management reputation has been put in jeopardy, followed by the coronavirus (COVID-19). Though it is less popular among Sri Lankan property developers, risk management strategies in development projects have become a pressing requirement. This paper's goal is to look at commercial property development risk elements from the perspective of a real estate developer in relation to Social, Economic, Environmental, Technological, Political, and Pandemic Risks. The research first evaluates risk variables using a super decision software model based on the Analytic Hierarchy Process (AHP), then prioritizes the most important risk factors, and lastly examines effective risk management measures for successful real estate developments. The data collection has been carried out using interviews through telephone conversations with the help of a structured questionnaire. Accordingly, 35 risk factors have been assessed altogether. For the three projects, the synthesized values were 1.0000, 0.510763, and 0.604037, respectively. Based on the analysis of superMatrix calculation, project A is regarded as the best alternative project in such circumstances. Pandemic Risk, Economic Risk, and Political Risk have all had a significant impact on the primary risk criteria. Therefore, COVID-19 Pandemic Risk Emergence, Workforce Availability, Duration, Delays in Council Approval/License Approval Process and Natural Disaster Impact were identified as the highest influenced sub-risk factors. Identifying the risk factors on this avenue will also help in making better investment decisions while increasing the unpredictable nature of the real estate field and future satisfaction of loan team investment goals within the country.

Keywords: Risk assessment, commercial real estate, Analytic Network Process, pandemic risk, COVID-19

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01.0 INTRODUCTION

Property development is a business activity that occurs mostly in the town area and encompasses a broad variety of operations ranging from real estate businesses activities to land subdivisions for commercial, residential, mixed type of development or industrial development (Zainudeen & Jeyamathan, 2008). Despite this, amid multiple conflicts, catastrophes and crises, the demand for real estate has risen worldwide. In addition, various sub-sectors of the real estate business have benefited from the worldwide boom. Real estate developers, brokerage businesses, property consultant service organizations, real estate financing firms, and real estate investors have expanded their activities beyond the local market towards penetrating international segments. Furthermore, it is critical to the development of developing economies such as Sri Lanka (Marzouk & Aboushady, 2018). In this setting, each real estate developer must be perceptive in bringing their development to market at the right time and at the right price, as development profits are finalized based on the developers' management of development costs over time, in contrast to the gross value of their development at the end of the project. Every developer faces several dangers and uncertainties during this voyage, as it necessitates a significant amount of cash as well as a team of experts with extensive expertise and knowledge, as well as talents to manage a wide range of interdependent activities. The key causes of development risks, according to Loizou and French (2012), include land cost, financial risk, building risk, socioeconomic risk, and sale or rent-related hazards. At the moment, industry experts around the world are concerned about the tremendous risk that the global epidemic of COVID-19 poses to the real estate market.

The real property market of the country, and other economic activities have suffered as a result of the stay-at-home policy. The consequences and integral hazards of stay-at-home rules on the built environment and real estate have shackled and caused plentiful delays to various operations (Uchehara et al., 2020). The duration and spread of the virus exert the level of the impact and recovery, and the ensuing route of recovery in economic activity, which still remain ambiguous. The epidemic caused the Sri Lankan economy to collapse at a pace of 3.9 percent between 2020 and 2021. The statistics ranged from a high 16.1 percent in March 2020 to a low -16.4 percent in June 2020 (CEIC Data, 2021). It is similar to the real estate sector and other industries as well. Unfortunately, the real estate segment is plagued with a bad reputation for risk management, with numerous investment projects failing and others functioning poorly or not at all (Nnamani,

2017), due to the risk management is not a popular practice among Sri Lankan property developers (Zainudeen & Jeyamathan, 2008). As a result, it is discovered that there is a significant knowledge gap about the likelihood of making judgments. Risks in property development have been the subject of current research. As elucidated by Ogunba et al. (2005), risk analysis is commonly emphasized in development evaluation papers throughout the world. As a result, risk management in development projects is an important topic to debate now.

This research intends to analyze the risks of ongoing commercial real estate development projects during coronavirus pandemic under three headings. To begin, the study uses super decision software to analyze risk variables utilizing a created Analytic Hierarchy Process (AHP) model against Technological, Social, Environmental, Political, Economic and Pandemic risk-criteria. Second, the work also identifies the substantially affected risk variables by selecting the important risk factors. Finally, the paper covers successful risk management measures for real estate development. Such additions also contribute significantly to the body of prevailing knowledge in this field.

02.0 LITERATURE REVIEW

2.1 Risks in Real Estate Development

Real estate development activity is the process of increasing the value of property by making physical alterations and perfections to it using a property developer's cash and business skills (Zainudeen & Jeyamathan, 2008). The property development sector encompasses a diverse range of companies and individuals engaged in the creation and management of real estate to satisfy the employment, housing and social demands of communities (UDIA, 2003). As a result of certain identical features of property investment, such as heterogeneous, decentralized market, impracticality of knowing the, significant amount of risk involved in investment decisions, real market price some inherent issues in low liquidity, property management, and providing a hedge against inflation, many wealthy people in Sri Lanka intend to invest in the real estate sector (Berry & McGreal, 1999). Moreover, property investment always carries many risks and uncertainties (Zainudeen & Jeyamathan, 2008).

Political, social, economic, environmental, and technical aspects all contribute to the risk of real estate property investment. The unpredictable currency rate, variable interest rate, and high inflation rate influence rental income and capital value, and socio-political instability such as militancy, insurgency, and kidnappings have resulted in property investment failures and financial suffering (Nnamani, 2017). In an analytical sense, risk is defined as the degree to which the actual outcome of an investing activity or choice may differ from the expected outcome (Ajayi, 1998; Burja & Burja, 2009; Enever & Isaac, 2002; Hargitay & Yu, 1993). Furthermore, everything about the result of an investment that is unknown at the moment the decision is made is referred to as uncertainty. The risk, on the other hand, is a measure of a loss that has been recognized as a likely result of an action (Byrne & Cadman, 1984). Due to the high levels of risk and uncertainty connected with the real estate building sector, projects must examine risk occurrences seen in their projects in order to eliminate vagueness, imprecision, and unavailable data and information (Marzouk & Aboushady, 2018). Real estate development might be faced with various risk factors. The common risks involve natural risk, political risk, economic risk, technical risk, and management risk. Business risks, political risks, financial risks, taxation risks, market risks, tenant risks, sector risks, structural risks, planning risks, timing risk and holding period risk, comparative risks, management and/or union risk, risk of unplanned uselessness, and interest rate risk are some of the other types of risk (Ajayi, 1998). Property development is innately hazardous, with significant barriers to entry, owing to the sector's cyclical and capital-intensive character, as well as the normally long payback time (Newell & Steglick, 2006).

Every facet of property investment risk has been widely addressed for many years, including the risk-reducing impacts of property in a portfolio, portfolio risk reduction through property diversification, risk premiums for property sectors, and the influence of valuation-pressing on property risk (Booth et al., 2002). Property development risk, on the other hand, has been documented for many years (Whipple, 1988), particularly given the importance of the property cycle and its strategic implications for real estate and development. (Pyhr et al., 1999). Now that the historical stages of the property development process have been generally established, most risk assessment methodologies focus on measuring property development risk rather than identifying, prioritizing, or evaluating significant risk aspects in the property development process (Cadman & Topping, 1995; Miles et al., 2000). The majority of these methodologies (Byrne & Cadman, 1996; Cadman & Topping, 1995) are focused on feasibility and cash flow analysis, with just a minor amount of emphasis dedicated to property development risk management (Cadman & Topping, 1995; Miles et al., 2000). There has also been devised a wide categorization of property development risk into four areas: commercial, c land, construction and social, as well as 21 sub-risk categories (Dullisear, 2001). Other research has focused on specific components of property development risk, such as development financing risk (Markham, 2001) and interest rate risk (Cameron et al., 1990). Property development risk has received scant attention overall. Prominent property developers in Australia have recently acknowledged the necessity to tighten their risk management limitations in order to retain their discipline in bidding for business and effectively completing projects (Newell & Steglick, 2006). In brief, all the real estate development risk factors are compiled in the following Table 1.

Table 1 Risk in commercial real estate development
(Source: Chen and Khumpaisal (2009) and edited by authors)

Criteria	Sub-Criteria	Valuation Methods	Representative References
Social risks	Workforce availability	Developer's satisfaction to local workforce market level (%)	Danter Company (2007)
	Community acceptability	Level of benefits to local communities (%)	Danter Company (2007)
	Cultural compatibility	Business & lifestyle harmony level (%)	Danter Company (2007)
	Public hygiene	Impacts on local public health & safety (%)	Boorman (2009)
Technological risks	Site conditions	Difficulties in site preparation for each specific plan (%)	Danter Company (2007)
	Designers and constructors	Developer' satisfaction of their performances level (%)	Khalafallah et al. (2005)
	Multiple functionalities	Multiple use of the property level (%)	Danter Company (2007)
	Constructability	Technical difficulties in construction level (%)	Lam et al. (2006)
	Duration	Total duration of the design and construction per 1,000 days (%)	Khalafallah et al. (2005)
	Amendments	Possibility of amendments in design and construction (%)	Khalafallah et al. (2005)
	Facilities management	Level of complexities in facilities management (%)	Moss et al. (2007)
	Accessibility & evacuation	Level of easy access and quick emergency evacuation in use (%)	Moss et al. (2007)
	Durability	Refurbishment requirements during buildings life cycle probability (%)	Chen (2007)
	Environmental risks	Adverse environment impacts	The overall Environmental Impacts Index value
Climate change		Level of impacts on use and value due to regional climatic variation (%)	UNEP (2007)
Impact of natural disasters		Level of impacts due to natural disaster	Thilini and Wickramaarachchi (2019)
Economic risks	Interest rate	Level of impacts due to the increase of loan rate (%)	Bank of England (2007); Frodsham (2007); FSA (2005); Nabarro and Key (2005); Sagalyn (1990)
	Property type	Level of location concentration (%)	Adair and Hutchison (2005); Frodsham (2007)
	Market liquidity	Selling rate of same kind of properties in the local market (%)	Adair and Hutchison (2005)
	Confidence to the market	Confidence level of the developer	Adair and Hutchison (2005)
	Demand and Supply	Level of regional competitiveness (%)	Adair and Hutchison (2005)
	Purchaseability	Level of affordability to the same kind of properties (%)	Carnoske et al. (2010)
	Brand visibility	Degree of developer's reputation in specific development (%)	Adair and Hutchison (2005); Dun & Bradstreet (2007); Gibson and Louargand (2002)
	Capital exposure	Rate of estimated lifecycle cost per 1 billion pounds (%)	Blundell et al. (2005); Moore (2006)
	Lifecycle value	5-year property depreciation rate (%)	Adair and Hutchison (2005); Lee (2003)
	Area accessibility	Level of regional infrastructures usability (%)	Adair and Hutchison (2005)
	Buyers	Expected selling rate (%)	Frodsham (2007)
	Tenants	Expected annual lease rate (%)	Booth et al. (2002)
	Investment return	Expected capitalization rate (%)	Sagalyn (1990); Watkins et al. (2004)
	Currency conversion	Level of impacts due to exchange rate fluctuation	Bank of England (2007); FSA (2005); Morledge et al. (2006)
	Scarcity of Land	Level of availability to finding suitable Land for the development (%)	Chen and Khumpaisal (2009) – valuation method is decided by authors
	Variations of the land prices	Level of impact to development cost due to land prices fluctuation (%)	Chen and Khumpaisal (2009) – valuation method is decided by authors
	Political Risks	Political Groups/Activist	Level of protest by the urban communities (%)
Commercial Tax Policy Local Tax Policy		Rate of Commercial Tax impact (%) Rate of Council Local Tax (%)	Bank of England (2007); Halman et al. (2007); LCC (2008)
Council Approval License Approving		Total days of construction, design approval process by Liverpool City Council (LCC) Total days of the license approval process	(Crown, 2008) (Crown, 2008)
Pandemic Risk	COVID-19 (Coronavirus)	Level of impact to commercial development during lockdown period (%)	Tanrıvermiş (2020)

2.2 Pandemic Risk and Its Impact on Real Estate Development

The pandemic is much more than a health-related concept; it also entails changes that might impact all sectors and living conditions. To put it another way, defining the parameters of a new normal endlessly is tiresome, and what should be done about human compensations, urban space, planning, housing, and other real estate investments looks to be on the table within this framework (Ling et al., 2020). The COVID-19 virus has infected over 5.8 million people in over 200 countries, according to research dated May 2020 (see GIS & Data). Health risks influence almost every business, but economic performance is severely impeded. The COVID-19 outbreak is viewed as a random occurrence with distinct features when compared to previous global crises (Çeti & Ünlüönen, 2019; Ponis & Ntalla, 2016). The pandemic has wreaked havoc on economic sectors and the economy as a whole; primarily emerging economies have been hit by a crisis, which has been followed by a significant risk and uncertainty of additional economic losses (Nicola et al., 2020). The COVID-19 pandemic phase, which has been defined as a global phenomenon that was unexpected, is unlike any previous crisis in history (Çeti & Ünlüönen, 2019; Ponis & Ntalla, 2016). In terms of transaction volume, credit utilization, and property values, the influence of the COVID-19 epidemic on the real estate market was investigated. Real estate sales have tended to climb in the preceding decade, but there was a drop in sales in March 2020 compared to the previous year. Due to a decline in the interest rates on occupied and house loans, which produces explosions on real estate sales (Tanrıvermiş, 2020), the recovery process might be observed from time to time. Due to this pandemic situation, many realtors and real estate developers as well as real estate investors face lots of difficulties in making decisions.

Pandemic crises and its global effects were defined as unanticipated event that had a negative impact on real estate project development, current real estate sales operations, cost estimates and valuations, and rates of return. Almost every sector and activity poses a health risk, but economic activities are under significant strain (Tanrıvermiş, 2020). Despite the fact that other countries have experienced epidemics after then, none have been as severe as COVID-19. According to the WHO, the COVID-19 pandemic is progressively becoming a permanent part of human life and activities (UNCTAD, 2020; Wang & Tang, 2020). Commercial real estate development, according to Gujral et al. (2020), might do more than react to coronavirus. By utilizing modern technology, real estate market development initiatives verified its survivability throughout the viral epidemic. The digital and virtual environments have been subjected to the electronic business transformation. The COVID-19 outbreak has altered the market and prompted it to adopt new business methods (Bethune & Korinek, 2020). The impact of COVID-19 on real estate market development projects was also felt, and the impact of COVID-19 on real estate market development projects has undoubtedly changed as a result of the virus's spread. The Chinese real estate business has risen to the challenge of becoming a virtual platform (Gross & Lin, 2020). During the COVID-19 period, the market value of real estate rose (Sanchaniya, 2021). According to China Merchants Securities, despite all attempts to keep the market afloat, sales have plummeted (China Merchants Securities, 2020). However, according to the National Association of Realtors (NAR, n.d.), the virus's presence in the US market has resulted in a decrease in real estate sales. Several comparable studies (Chauhan & Kapoor, 2021; Tanrıvermiş, 2020; Uchehara et al., 2020) have offered their perspectives on the coronavirus' impact on the global real estate market. When the COVID-19 pandemic initially broke out in the Asia-Pacific region and expanded over the world, the real estate sector was the first to suffer the repercussions (JLL, 2020)

2.3 Real Estate Development Risk Management

Risk management may be defined as a sequence that includes risk analysis, risk response, and risk control (Gehner, 2003). The majority of the research focuses on risk analysis approaches that are used to detect and analyze hazards. The majority of the existing research focuses on methodologies of risk analysis that are used to detect and analyze hazards. Risk analysis is simply one component of risk management; it aims to make hazards clear in either a qualitative or quantitative manner. Several risk analysis approaches are discussed in the context of project and construction management, including sensitivity, scenario, stochastic analysis, the expected-monetary-value method, and the risk-adjusted-discount rate method (Byrne & Cadman, 1984; Flanagan & Norman, 1993; Leung & Hui, 2002; Raftery, 1994). As real estate development is not the same as gambling, one must depend heavily on subjective risk assessments, also known as risk perception (Sitkin & Pablo, 1992). The risk response or choice is based on people's risk proclivity or readiness to incur risks deliberately (Simon et al., 2000). The development of alternative investment selection options is designed to limit risk occurrences or predicted losses (Al-Bahar & Crandall, 1990). Numerous researchers (Chapman, 2011; Flanagan & Norman, 1993; Smith et al., 2006) have carried out research using risk management strategies and models. Intuition, judgment, and experience are the most often applied risk assessment strategies (Akintoye & MacLeod, 1997; Lyons & Skitmore, 2004). Furthermore, real estate developers and investors were identified as important hurdles to implementing risk management in the conceptual or early stages of a project life cycle due to a lack of awareness of risk assessment techniques and a lack of understanding of its potential benefits (Uher & Toakley, 1999). Risk is a typical occurrence in the construction business, and the act of managing it is important at various phases of the real estate development process (Udoudoh, 2020).

03.0 METHODOLOGY

Past literature has analyzed 32 sub risk factors under the Analytic Network Process model (Thilini & Wickramaarachchi, 2019). However, in this research, three new risk factors like the impact of COVID-19, variation of land prices, scarcity of land have been added with a different methodology. Only one risk factor is missed under Environmental risk because of the unavailability of data of Environmental Impacts Index value. Accordingly, altogether 35 risk factors were assessed using Analytic Hierarchy Process technique. This strategy involves organizing the problem into a hierarchy and using a combination of quantitative and qualitative criteria to solve it. Because this strategy is to define the problem as a hierarchy and believe in a blend of quantitative and qualitative criteria, it is shown to make judgments

using numerous criteria. This method, known as included AHP, can yield a more accurate and likely assessment when compared to stand-alone AHP (Ho, 2008). The study's conceptual framework is represented in Figure 1 below.

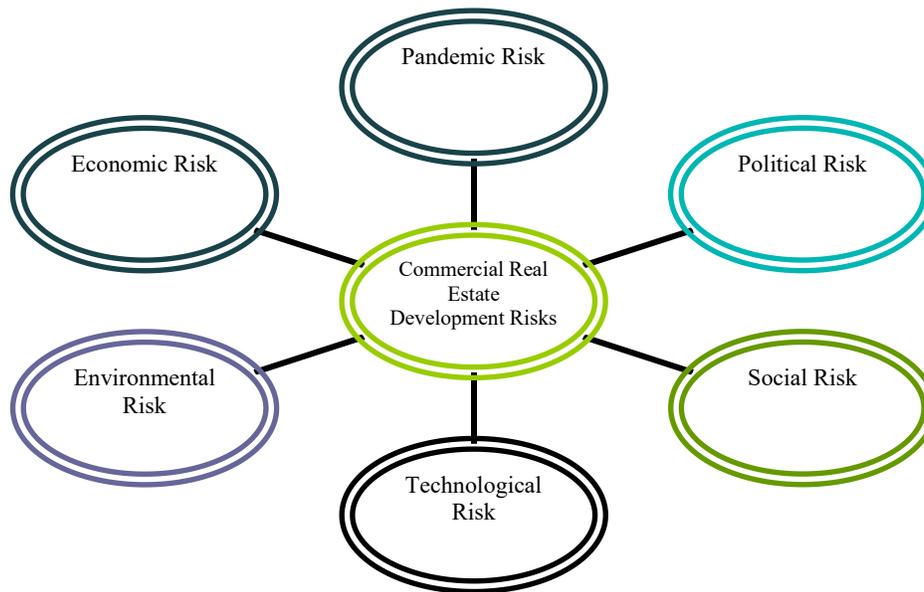


Figure 1 Conceptual framework of the study
(Source: Authors' compilation)

3.1 Data Collection Procedure

The primary data collection was carried out through telephone conversations, through a set of structured questionnaires, for the purpose of collecting data on three respective real estate developers' opinions on risk in commercial real estate development amidst the COVID-19 pandemic. There were six primary risk factors (social risk, environmental risk, technological risk, economic risk, political risk, and pandemic risk) as well as 35 sub-criteria.

3.2 Case Study Area

In Sri Lanka, districts highly affected by the COVID-19 outbreak were Colombo and Gampaha, as identified by the health officials. Accordingly, Gampaha, Ja-Ela and Ekala were selected representing Gampaha District to identify real estate development risk factors during COVID-19.

3.3 Sample

Three, out of many commercial projects in the urban area were selected within Gampaha, Ja-Ela and Ekala areas, based on the closeness to the city center, type of the development and being convenient to the researchers. Project A is the ideal location for a retail and office complex. The property has been designated by statutory authorities as a suitable zone for the development of a commercial complex with 196 stores and over 12,000 square feet of office space, as well as 10 escalators and four elevators, two observation lifts, a basement parking garage, and all utilities. The seven floors include the ground floor. This is approximately a rectangular shape development. Project B is a shopping complex. There are ample parking facilities. The land is located in an ideal zone, only 6 km from Bandaranayake International Airport, 25 km from Colombo. There are 5 floors consisting with ground floor, and this is L shaped designed complex. Project C is a structure of 500 shopping units with each approximately 200 sqft in area, a 6,000 sqft branch of a leading supermarket chain, and an industrial zone. All shops also comprise individual toilets and other standard facilities, and parking. There are 5 floors consisting with ground floor, and this design is just different and approximately curved in shape.

3.4 Data Analysis Method

This research intends to provide a risks analysis of commercial real estate development projects during the coronavirus pandemic n under three headings; firstly, to evaluate the risk factors utilizing Analytic Hierarchy Process (AHP) model against Social, Political, Economic, Technological, Environmental, and Pandemic risk criteria, using super decision software (following steps 1, 2 and 3). Under step 4, the key risk factors are prioritized to identify the highly affected risk factors.

3.4.1 Analytic Hierarchy Process (AHP)

As mentioned by Nermend (2017), AHP (Analytic Hierarchy Process), ANP (Analytic Network Process), The REMBRANDT method, ELECTRE (Elimination Et Choix Traduisant la Réalité), DEMATEL (Decision Making Trial and Evaluation Laboratory), and PROMETHEE are just a few examples of expert multiple-criteria decision-making techniques (Preference Ranking Organization Method for Enrichment of Evaluations).

The AHP method, created by Thomas L. Saaty in the 1970s (Saaty, 1980), assumes that all criteria (attributes) are independent (Brunelli, 2015). Because they may be divided into sub-criteria, the criteria have a hierarchical structure. The ANP technique was added to the AHP approach, which was also anticipated by Thomas L. Saaty and suggests that there may be interaction and dependency between the criteria (attributes) (Saaty & Vargas, 2006). The REMBRANDT method relies on pairwise metric comparisons, however it lacks a hierarchical structure (Nermend, 2017). The DEMATEL approach divides the interrelationships amongst the criteria (in this example, real estate qualities) into cause and effect groupings (Si et al. 2018). The ELECTRE group techniques, based on the outranking approach, provide for alternate selection, ranking, and sorting (Nowak, 2004). The purpose of the PROMETHEE approach is not to select the "correct" or "best" decision, but rather the one that best matches the goal. It also allows for the identification and quantification of conflicts and synergies, decision clusters, and the selection of primary options (Brans & Mareschal, 2005). The aforementioned methodologies have already been used in the well-known real estate market or urban study. The PROMETHEE approach, for example, was used to assess urban redevelopment activities in Northern Italy (Bottero et al., 2018). The DEMATEL approach was used to break down correlations between real estate attributes into causal and categories (Gołabeska, 2018). In commercial real estate development, the ANP approach is used to analyze risk (Chen & Khumpaisal, 2009; Thilini & Wickramaarachchi, 2019). The AHP approach was also applied, which is the main emphasis of the current study. The efforts to utilize AHP to govern the weights of market features (Kozioł-Kaczorek, 2012) are substance in the context of the current study; the instigator also recommends enhancing the AHP technique aspects of goal-programming (Kozioł-Kaczorek, 2014). A similar technique was provided in the study, which involved comparing derived weights to various counter-proposals (Kryvobokov, 2005). The efficiency of the AHP approach was also proven in this case, with the local real estate market in Sri Lanka as a case study. The current study takes a further step by using the weights established by various real estate appraisal systems in both individual and mass approaches. Apart from the inspection of market weights alone, a review of valuation findings is offered, which provides a holistic picture of the AHP method's utility. The analytic hierarchy process (AHP) would be appropriate in instances where there is a lot of ambiguity (Saaty, 1980, 1994, 1996; Saaty & Vargas, 1991).

AHP is also a framework for problem-solving (Saaty, 1986) and a measurement theory (Saaty, 1990) that has been offered as a decision-making approach for evaluating complicated multi-attribute options among one or many decision-makers. It is considered an enhancement over other decision-making approaches since it allows for the integration of subjective elements (Emrouznejad & Marra, 2017). The AHP approach's calculus is briefly outlined here, with an emphasis on the important assumptions that underpin the needed pairwise comparison and prioritizing (Saaty & Vargas, 1991).

Hierarchy creation, priority analysis, and consistency verification are the three main processes of the AHP. To begin, decision-makers must decompose complicated multiple-criteria decision issues into its constituent parts, with each conceivable feature organized into numerous hierarchical levels using the AHP technique. The decision-makers must next compare each cluster pair-wise at the same level, based on their own experience and expertise. For example, in the second level, every two criteria are connected at a time with regard to the objective, but in the third level, every two aspects of the same criterion are linked at a time regarding the corresponding criterion. Some discrepancy may have occurred since the comparisons were made based on personal or subjective opinions. The fourth operation, uniformity verification, is coupled to quantify the degree of uniformity among the pair-wise comparisons by computing the consistency ratio to verify the findings are credible. It is regarded as one of the key benefits of the AHP. If AHP is deemed to be one of the most complete systems (Ho, 2008), it reflects the need to make judgments based on a variety of factors since this technique articulates the criminal as a hierarchy and believes in a combination of quantitative and qualitative principles. This strategy, referred to as integrated AHP, can produce more accurate and favorable results than a stand-alone AHP (Ho, 2008). The AHP's series of steps is depicted in Figure 2.

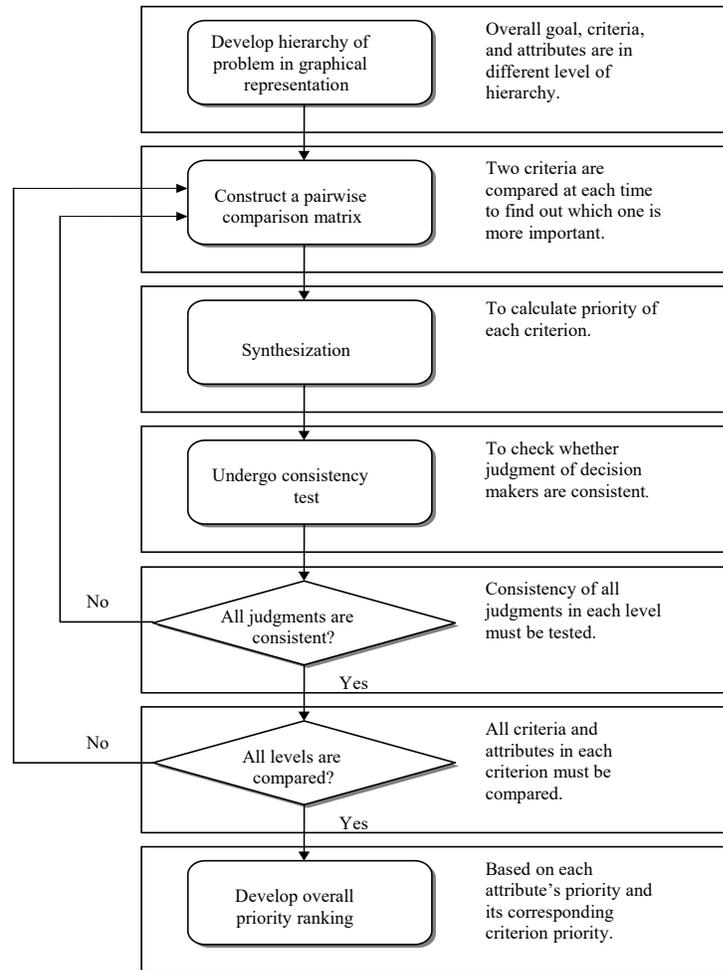


Figure 2 The flowchart of the Analytic Hierarchy Process (Source: Ho et al., 2006)

04.0 RESULTS AND DISCUSSION

To gauge the risk of commercial real estate development projects, four following steps have been taken:

Step 1: Hierarchical Structure of Selecting Best Real Estate Development Project

Utilizing super decision software, the risk assessment model was created. The AHP model for commercial real estate development projects is depicted in the diagram below.

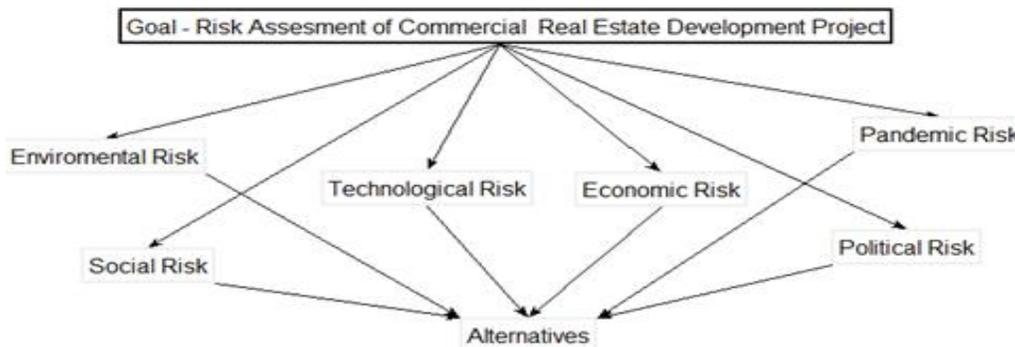


Figure 3 AHP model structure (Source: Designed by authors)

Step 2: Pairwise Comparison

There are a variety of pairwise comparison judgments that lead to the calculation of factor weights and factor evaluations. The finest alternative development project is selected from among those with the greatest overall weighted score. In pair-wise comparisons, a real estate developer, or any other decision maker must rank two options on a linguistic scale ranging from equally-desired to strongly-preferred, as mentioned. The expert prioritizing tool represents the relative relevance of the criteria by providing a number (see Table 2) provided by (Saaty, 1980, 1996). The means for calculating importance are pairwise comparisons of these elements' backgrounds (Sharma et al., 2008).

Table 2 Pairwise comparison scale

Intensity of importance	Explanation
1	Two criteria are equally important in achieving the goal
3	When it comes to experience and judgment, one has a little advantage over the other
5	Experience and judgment favor one over the other
7	Criterion is heavily preferred, as evidenced by its prevalence in practice
9	The supremacy of one over the other is proclaimed to the maximum degree imaginable
2, 4, 6, 8	Used to symbolize a compromise between the above-mentioned criteria

Source: In AHP, multiple pairwise comparisons are based on a standardized comparison scale of nine levels (Albayrak & Erensal, 2004; Arslan & Turan, 2009; Dinçer & Görener, 2011; Kandakoglu et al., 2009; Kangas et al., 2001; Kajanus et al., 2004; Kurttila et al., 2000; Lee & Walsh, 2011; Pesonen et al., 2001; Saaty, 1996; Yüksel & Dağdeviren, 2007).

Step 3: Synthesization

The alternatives' overall priorities generated by synthesizing the priorities of the alternatives of all the sub-networks are the key findings of an AHP model. The findings of the AHP model are shown in the table below.

Table 3 Synthesized value
(Source: Authors' compilation)

Name	Ideals	Normals	Raw
Project A	1.000000	0.472858	0.236429
Project B	0.510763	0.241518	0.120759
Project C	0.604037	0.285624	0.142812

If the network is a bottom level decision network, the values for each alternative are pulled straight from the network's Limit Matrix, according to the Super Decision software guide Raw (Adams & Saaty, 2003). The control criterion nodes are normalized and multiplied by the Ideal values of the alternative vectors from the networks underneath them if the network is a transitional network with control criteria. These subjective vectors are then combined to generate the raw vector. By adding the fundamentals to it and then dividing each element by the sum, the normalized vector of priority for the alternatives is formed. The fundamentals of normalized vector summation to 1. In the synthesis table, the raw values are multiplied by the standard column. By dividing each member in the vector by the biggest, the raw priority vectors are turned into unrealistic values, with the best option receiving a significance of 1 and the others receiving their respective percentage less than 1. In the synthesis table above, these are the values in the Standards column. As a result, project A is the finest alternative development project.

Step 4: Overall Priority Ranking

Finally, the priority vectors for the alternatives that have been passed up to the top level are balanced according to the priority of Benefits, Costs, Opportunities, and Risks to produce an overall normalized priority vector for the alternatives and restrict them in terms of the Hierarchy.

Table 4 Prioritized main risk factors
(Source: Authors' compilation)

Risk Factors	Normalized by clusters	Limiting	Ranking
Social Risk	0.25000	0.020833	4
Technological Risk	0.11111	0.009259	5
Environmental Risk	0.50000	0.005208	6
Economic Risk	0.06250	0.041667	2
Political Risk	0.33333	0.027778	3
Pandemic Risk	1.00000	0.083333	1

In accordance with the results delineated in Tables 3 and 4, project A is the finest alternative development project and highly affected risk factor is the pandemic risk, which affects real estate project developments due to significant increases in material cost, decrease in rent collection, operating cost, losses as a result of declines in demand, investment value and net operating income. To manage these risks, every developer needs to change business orientation strategically through work planning, proper supply change management, proper technology usage, increasing safety and facility management to reduce construction delays. Second, the volatility of the real estate market has a significant impact on economic risk. In Sri Lanka, high inflation rate, interest rate, unemployment rate and increasing poverty were observed after the pandemic. Thirdly, political risk is another considerable risk factor in Sri Lanka; changes in policy, development regulations, lack of proper mechanisms, and poor decision-making highly affect every industry's development. The results further revealed that Pandemic risk, Economic risk and Political risk are highly affected main risk criteria. Consequently, COVID-19 pandemic risk emerged, workforce availability, duration, delays in Council Approval /License Approval process, Natural Disaster impact are identified as the highest influences on sub risk factors.

Commercial real estate, as per Gujral et al. (2020), might do more than only respond to coronavirus. Surprisingly, the findings support this, and pandemic risk has a significant impact on Sri Lankan commercial real estate growth. The epidemic has wreaked havoc on the economy's sectors and structure. Developing economies were in the midst of a crisis, with a significant danger of further economic losses (Nicola et al., 2020). During the COVID-19 period, the real estate market value surged (Sanchaniya, 2021). Despite all attempts to keep the market afloat, real estate deals have decreased, as reported by China Merchants Securities (2020). However, the National Association of Realtors reports that the virus's arrival on the US market has resulted in a decline in real estate sales (NAR, n.d.). Several linked articles (Chauhan & Kapoor, 2021; Tanrıvermiş, 2020; Uchehara et al., 2020) discuss the impact of the coronavirus on real estate business. Comparing those results, it is certain that economic risk is a highly affected factor and it makes an impact on development activities; at present, inflation rate, borrowing rate, interest rate, currency conversion problem and several other matters have affected real estate and other sectors, and everything is in an unpredictable situation.

4.1 Risk Management during COVID-19

Presently, it is a good opportunity to assess COVID-19's influence on development organizations, both internally and publicly, by conducting a thorough study. This includes identifying mission-essential tasks, equipment, and people, as well as defining how, where, and by whom important services are delivered; and, in particular, contemplating suspending certain areas of work to limit risk of exposure, facilitate social distancing, and save money. It guarantees that staff availability, health, and safety are all closely monitored. Since COVID-19 has the potential to harm everyone, a stability plan for all business-critical personnel must be devised that can be immediately activated if they get ill. All important functions must have alternatives and designates, and the chain of command must be clearly defined. Furthermore, health and safety, employee rules, vital service, insurance, travel, and contractual difficulties all arise, and it is critical to grasp current insurance plans and guidance. At that point, financial advisers, loans, government programs, deferrals, and other resources are accessible to developers, as well as how they might obtain them. Finally, employees may require assistance. Those factors might also aid in improving the success of development initiatives.

05.0 CONCLUSION

The property development sector is made up of a diverse group of companies and individuals who construct and operate real estate to suit the housing, employment, and social demands of communities. It entails a great level of risk and uncertainty since it necessitates a substantial sum of cash, high competence, and a knowledgeable team of experts with various skill and ability sets to manage a diverse range of interdependent tasks. Political, social, economic, environmental, and technical issues all increase the risks associated with real estate investing. Variable currency rates, high and volatile interest rates, and inflation have an impact on rental income and capital value, while socio-political uncertainty, such as insurgency, kidnappings, and militancy, has led to property investment failures and financial distress. Land cost, financial risk, building risk, socioeconomic risk, and sale or rent-related hazards are the key causes of development risks. At present, the global epidemic of COVID-19 has generated worries among industry experts throughout the world about the huge threat it poses to the real estate business. Regrettably, the business has a bad reputation for risk management, with numerous investment

projects collapsing and others functioning poorly or not at all, and risk management is not widely practiced among Sri Lankan property developers. As a result, it is discovered that there is a significant gap with no information on the likelihood of receiving the choices. During the coronavirus pandemic, this research investigated the commercial property development risk elements from the perspective of a real estate developer versus Social, Economic, Environmental, Technological, Political, and Pandemic Risks. For the three projects, as per the super matrix computation, the synthesized values were 1.0000, 0.510763, and 0.604037, respectively, resulting in a priority of 1 for the best alternative and a percentage less than 1 for the others. Project A is the best alternative project during this situation. The results further revealed that Pandemic risk, Economic risk and political risk are highly affected main risk criteria. COVID-19 Pandemic Risk, Workforce Availability, Duration, Delays in Council Approval /License Approval Process, and Natural Disaster Influence are some of the sub risk variables that have a significant impact on real estate projects in pandemic scenarios. Pandemic risk is a substantially influenced risk element in the real estate business, according to current previous research. Nonetheless, the council approval procedure, the impact of natural disasters, and political risk have all been highlighted as significantly impacted risk factors. In general, inflation, interest, financial, market, and tenant concerns have effects that are comparable to promoting social separation and avoiding wasteful cash outlays by closely monitoring employees and workers online. As everyone is at danger of being directly harmed by COVID-19, a continuity strategy for all critical persons and enterprises must be established that can be promptly triggered if they get ill. For all key functions, the chain of command must be clearly specified, and alternatives and designations must be adopted. Proper supply chain management, proper technology usage, increasing safety and facility management will also help reduce delays in construction and if a developer is capable of managing such critical situations, that is the best way to achieve the long term investment goal.

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References

- Adair, A., & Hutchison, N. (2005). The reporting of risk in real estate appraisal property risk scoring. *Journal of Property Investment & Finance*, 23(3), 254-268.
- Adams, W. J. L., & Saaty, R. (2003). Super decisions software guide. Retrieved from https://superdecisions.com/sd_resources/v28_man01.pdf
- Ajayi, C. A. (1998). *Property investment valuation and analysis*. Ibadan: De-Ayo Publications.
- Akintoye, A. S., & MacLeod, M. J. (1997). Risk analysis and management in construction. *International Journal of Project Management*, 15(1), 31-38.
- Al-Bahar, J. F., & Crandall, K. C. (1990). Systematic risk management approach for construction projects. *Journal of Construction Engineering and Management*, 116(3), 533-546.
- Albayrak, E., & Erensal, Y. C. (2004). Using analytic hierarchy process (AHP) to improve human performance: An application of multiple criteria decision making problem. *Journal of Intelligent Manufacturing*, 15(4), 491-503.
- Arslan, O., & Turan, O. (2009). Analytical investigation of marine casualties at the Strait of Istanbul with SWOT-AHP method. *Maritime Policy & Management*, 36(2), 131-145.
- Arthurson, K. (2001). Achieving social justice in estate regeneration: The impact of physical image construction. *Housing Studies*, 16(6), 807-826.
- Bank of England. (2007, April). Financial stability report. Retrieved on 30 December 2007 from <https://www.bankofengland.co.uk/-/media/boe/files/financial-stability-report/2007/april-2007.pdf>
- Berry, J., & McGreal, S. (Eds.). (1999). *Cities in the Pacific Rim: Planning systems and property markets*. New York, NY: E & FN Spon.
- Bethune, Z. A., & Korinek, A. (2020, April). *COVID-19 infection externalities: Trading off lives vs. livelihoods* (NBER Working Paper No. 27009). Retrieved from https://www.nber.org/system/files/working_papers/w27009/w27009.pdf
- Blundell, G. F., Fairchild, S., & Goodchild, R. N. (2005). Managing portfolio risk in real estate. *Journal of Property Research*, 22(2-3), 115-136.
- Boorman, S. (2009). *NHS health and well-being* [Final report]. London: Department of Health. Retrieved from <http://www.nhshealthandwellbeing.org/FinalReport.html>
- Booth, P. M., Matysiak, G. A., & Ormerod, P. (2002). *Risk measurement and management for real estate investment portfolios* [Summary report]. London: Investment Property Forum.
- Bottero, M., D'Alpaos, C., & Oppio, A. (2018). Multicriteria evaluation of urban regeneration processes: An application of PROMETHEE method in Northern Italy. *Advances in Operations Research*, 2018, 9276075.
- Brans, J.-P., & Mareschal, B. (2005). Promethee methods. In J. Figueira, S. Greco & M. Ehrgott (Eds.), *Multiple criteria decision analysis: State of the art surveys* (pp. 163-195). New York, NY: Springer.
- Brunelli, M. (2015). *Introduction to the Analytic Hierarchy Process*. Cham: Springer.
- Burja, C., & Burja, V. (2009). The risk analysis for investments projects decision. *Annales Universitatis Apulensis Series Oeconomica*, 11(1), 98-105.
- Byrne, P., & Cadman, D. (1984). *Risk, uncertainty, and decision-making in property development*. London: Spon.
- Byrne, P., & Cadman, D. (1996). *Risk, uncertainty and decision-making in property development* (2nd ed.). London: E & FN Spon.
- Cadman, D., & Topping, R. (1995). *Property development* (4th ed.). London: Spon.
- Cameron, S., Holme, K., & Rapport, A. (1990). Managing interest rate risk in real estate development. *Journal of Applied Corporate Finance*, 3(1), 56-64.
- Carnoske, C., Hoehner, C., Ruthmann, N., Frank, L., Handy, S., Hill, J., ... Brownson, R. (2010). Developer and realtor perspectives on factors that influence development, sale, and perceived demand for activity-friendly communities. *Journal of Physical Activity and Health*, 7(s1), S48-S59.
- CEIC Data. (2021). Sri Lankan economy. Retrieved from <https://www.ceicdata.com/en/country/sri-lanka>
- Çeti, B., & Ünlüönen, K. (2019). Salgın hastalıklar sebebiyle oluşan krizlerin turizm sektörü üzerindeki etkisinin değerlendirilmesi [Evaluation of the effect of crisis due to epidemic diseases on the tourism sector]. *AHBVÜ Turizm Fakültesi Dergisi*, 22(2), 109-128.
- Chapman, R. J. (2011). *Simple tools and techniques for enterprise risk management* (2nd ed.). Chichester: John Wiley & Sons.
- Chauhan, A. S., & Kapoor, S. (2021). Impact of coronavirus on Indian real estate [Blog post]. Retrieved from <https://corporate.cyrilamarchandblogs.com>
- Chen, Z. (Ed.). (2007). *Multicriteria decision-making for the sustainable built environment: Proceedings of the 2006 Whiteknights workshop on MCDM*. Berkshire: University of Reading.
- Chen, Z., & Khumpaisal, S. (2009). An analytic network process for risks assessment in commercial real estate development. *Journal of Property Investment & Finance*, 27(3), 238-258.
- Chen, Z., Li, H., & Wong, C. T. C. (2005). *EnvironalPlanning: Analytic network process model for environmentally conscious construction planning*. *Journal of Construction Engineering and Management*, 131(1), 92-101.
- China Merchants Securities. (2020). *Corporate finance and capital market*. Retrieved from <http://www.cmschina.com.hk/en/CorpFin/Info>
- Crown Copyright. (2008). Building regulations. Planning portal. Retrieved from <http://www.planningportal.gov.uk/england/professionals/en/4000000000001.html>
- Dun & Bradstreet (2007). Risk management. Retrieved on 30 December 2007 from http://www.dnb.co.uk/Risk_Management/Risk_Management.asp
- Danter Company. (2007). A sample lodging analysis in the City of Grove, Ohio. Retrieved from www.danter.com/PRODUCT/samplodg.pdf

- Dinçer, H., & Görener, A. (2011). Performans değerlendirmesinde AHP-TOPSIS ve AHP-VIKOR yaklaşımları: Hizmet sektöründe bir uygulama [Performance evaluation using AHP-VIKOR and AHP-TOPSIS approaches: The case of service sector]. *Mühendislik ve Fen Bilimleri Dergisi*, 29(3), 244-260.
- Dullisear, R. (2001). Checklist helps tick off how to avoid pitfalls during development. *Australian Property Journal*, 36(6), 509-514.
- Emrouznejad, A., & Marra, M. (2017). The state of the art development of AHP (1979-2017): A literature review with a social network analysis. *International Journal of Production Research*, 55(22), 6653-6675.
- Enever, N., & Isaac, D. (2002). *The valuation of property investments* (6th ed.). London: Estates Gazette.
- Financial Services Authority (FSA). (2005). Strengthening capital standards. Retrieved on 30 December 2007 from http://www.fsa.gov.uk/pubs/cp/cp05_03.pdf
- Flanagan, R., & Norman, G. (1993). *Risk management and construction*. Boston, MA: Blackwell Scientific.
- Frodsham, M. (2007, December). *Risk management in UK property portfolios: A survey of current practice* [Research findings]. London: Investment Property Forum.
- Gehner, E. (2003). *Risicoanalyse bij projectontwikkeling*. Amsterdam: Uitgeverij SUN.
- Gibson, V. A., & Louargand, M. (2002, April). *Risk management & the corporate real estate portfolio*. Paper presented at the American Real Estate Society Annual Meeting, Naples, FL. Retrieved from www.reading.ac.uk/LM/LM/fulltxt/0202.pdf
- GIS & Data. (<https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6>)
- Gołabeska, E. (2018). The DEMATEL method in the analysis of the residential real estate market in Białystok. *Real Estate Management and Valuation*, 26(1), 16-25.
- Gross, M., & Lin, C. (2020). Comparison of real estate management system in China and Poland. *Real Estate Management and Valuation*, 28(1), 13-27.
- Gujral, V., Palter, R., Sanghvi, A., & Vickery, B. (2020, April 9). Commercial real estate must do more than merely adapt to coronavirus. *McKinsey & Company*. Retrieved from <https://www.mckinsey.com/industries/private-equity-and-principal-investors/our-insights/commercial-real-estate-must-do-more-than-merely-adapt-to-coronavirus>
- Halman, J. I. M., Gehner, E., & de Jonge, H. (2006, April 6-7). Risk management in the Dutch real estate development sector: A survey. In D. Amarutunga, R. Haigh, R. Vrijhoef, M. Hamblett, & C. van den Broek (Eds.), *Proceedings of the 6th International postgraduate research conference in the built and human environment* (pp. 541-552). Salford: SCRI.
- Hargitay, S. E., & Yu, S.-M. (1993). *Property investment decisions: A quantitative approach*. London: E & FN Spon.
- Ho, W. (2008). Integrated analytic hierarchy process and its applications – A literature review. *European Journal of Operational Research*, 186(1), 211-228.
- Ho, W., Dey, P. K., & Higson, H. E. (2006). Multiple criteria decision making techniques in higher education. *International Journal of Educational Management*, 20(5), 319-337.
- Jones Lang LaSalle (JLL). (2020, April 19). COVID-19: Global real estate implications. Retrieved from <https://www.jll.co.uk/en/trends-and-insights/research/covid-19-global-real-estate-implications>
- Kajanus, M., Kangas, J., & Kurttila, M. (2004). The use of value focused thinking and the A'WOT hybrid method in tourism management. *Tourism Management*, 25(4), 499-506.
- Kandakoglu, A., Celik, M., & Akgun, I. (2009). A multi-methodological approach for shipping registry selection in maritime transportation industry. *Mathematical and Computer Modelling*, 49(3-4), 586-597.
- Kangas, J., Pesonen, M., Kurttila, M., & Kajanus, M. (2001, August 2-4). *A'WOT: Integrating the AHP with SWOT analysis*. Paper presented at the Sixth International Symposium on the Analytic Hierarchy Process (6th ISAH), Berne, Switzerland.
- Khalafallah, A. M. G., Taha, M. A., & El-Said, M. (2005, November 21-22). *Estimating residential projects cost contingencies using a belief network*. Paper presented at the Management Engineering Society Conference (Project management: Vision for better future conference), Cairo, Egypt.
- Kozioł-Kaczorek, D. (2012). Hierarchizacja cech nieruchomości z zastosowaniem analitycznego procesu hierarchicznego [Analytic Hierarchy Process and characteristics of real estate]. *Studia i Materiały Towarzystwa Naukowego Nieruchomości*, 20(1), 165-174.
- Kozioł-Kaczorek, D. (2014). The use of combined multicriteria method for the valuation of real estate. *Optimum. Studia Ekonomiczne*, 5(71), 208-218.
- Kryvobokov, M. (2005). Estimating the weights of location attributes with the Analytic Hierarchy Process in Donetsk, Ukraine. *Nordic Journal of Surveying and Real Estate Research*, 2(2), 7-31.
- Kurttila, M., Pesonen, M., Kangas, J., & Kajanus, M. (2000). Utilizing the analytic hierarchy process (AHP) in SWOT analysis — A hybrid method and its application to a forest-certification case. *Forest Policy and Economics*, 1(1), 41-52.
- Lam, P. T. I., Chan, A. P. C., Chan, D. W. M., Chan, E. H. W., Wong, F. K. W., & Wong, F. W. H. (2006). *A model for buildability assessment in Hong Kong* [Research monograph]. Hong Kong: The Hong Kong Polytechnic University.
- Lee, S., & Walsh, P. (2011). SWOT and AHP hybrid model for sport marketing outsourcing using a case of intercollegiate sport. *Sport Management Review*, 14(4), 361-369.
- Lee, S. L. (2003). *When does direct real estate improve portfolio performance?* (Working paper No. 17/03). Reading: Henley Business School. Retrieved from www.reading.ac.uk/LM/LM/fulltxt/1703.pdf
- Leung, B. Y. P., & Hui, E. C. M. (2002). Option pricing for real estate development: Hong Kong Disneyland. *Journal of Property Investment & Finance*, 20(6), 473-495.
- Ling, D. C., Wang, C., & Zhou, T. (2020). A first look at the impact of COVID-19 on commercial real estate prices: Asset-level evidence. *The Review of Asset Pricing Studies*, 10(4), 669-704.
- Liverpool City Council (LCC). (2008). Liverpool city council property tax. Retrieved from <https://liverpool.gov.uk/>
- Loizou, P., & French, N. (2012). Risk and uncertainty in development: A critical evaluation of using the Monte Carlo simulation method as a decision tool in real estate development projects. *Journal of Property Investment & Finance*, 30(2), 198-210.
- Lyons, T., & Skitmore, M. (2004). Project risk management in the Queensland engineering construction industry: A survey. *International Journal of Project Management*, 22(1), 51-61.
- Markham, J. (2001). Development finance: Analysing structures here and internationally. *Australian Property Journal*, 36, 695-703.
- Marzouk, M., & Aboushady, A. (2018). Modeling risks in real estate development projects: A case for Egypt. *International Journal of Strategic Property Management*, 22(6), 447-456.
- Miles, M. E., Berens, G., & Weiss, M. A. (2000). *Real estate development: Principles and process* (3rd ed.). Washington, DC: Urban Land Institute.
- Moore, W. (2006). *Five ways to reduce commercial real estate risks* [Working paper]. Beaverton, OR: Pacific Security Capital. Retrieved from www.pacificsecuritycapital.com/index.cfm?action=hom_data&pageid=364
- Morledge, R., Smith, A., & Kashiwagi, D. T. (2006). *Building procurement*. Oxford: Blackwell Science.
- Moss, Q. Z., Alho, J., & Alexander, K. (2007). Performance measurement action research. *Journal of Facilities Management*, 5(4), 290-300.
- Nabarro, R., & Key, T. (2005, April). Performance measurement and real estate lending risk. In *BIS Papers No. 21: Real estate indicators and financial stability* (pp. 70-90). Basel: Bank for International Settlements (BIS). Retrieved from www.bis.org/publ/bppdf/bispap21.html
- National Association of Realtors (NAR). (n.d.). *Commercial & investment real estate*. Retrieved from <https://www.nar.realtor/commercial-investment-real-estate>
- Nermend, K. (2017). *Metody analizy wielokryterialnej i wielowymiarowej we wspomaganiu decyzji* [Methods of multi criteria and multidimensional analysis in decision making]. Warsaw: Wydawnictwo Naukowe PWN.
- Newell, G., & Steglick, M. (2006). Assessing the importance of property development risk factors. *Pacific Rim Property Research Journal*, 12(1), 22-37.
- Nicola, M., Alsaifi, Z., Sohrabi, C., Kerwan, A., Al-Jabir, A., Iosifidis, C., ... Agha, R. (2020). The socio-economic implications of the coronavirus pandemic (COVID-19): A review. *International Journal of Surgery*, 78, 185-193.
- Nnamani, O. C. (2017). Application of quantitative risk assessment techniques in property investment appraisal in Enugu Urban, Nigeria. *Journal of Land Management and Appraisal*, 5(1), 23-41.
- Nowak, M. (2004). Metody ELECTRE w deterministycznych i stochastycznych problemach decyzyjnych [ELECTRE methods in deterministic and stochastic decision problems]. *Decyzje*, (2), 35-65.
- Ogunba, O. A., Ojo, O., & Boyd, T. P. (2005, July 4-5). Assessing development appraisal risk with reference to client specific risk tolerance and perspectives. In A. C. Sidwell (Ed.), *QUT Research Week 2005: Conference Proceedings*. Brisbane: Queensland University of Technology.

- Pesonen, M., Kurttila, M., Kangas, J., Kajanus, M., & Heinonen, P. (2001). Assessing the priorities using A'WOT among resource management strategies at the Finnish forest and park service. *Forest Science*, 47(4), 534-541.
- Ponis, S. T., & Ntalla, A. (2016). Crisis management practices and approaches: Insights from major supply chain crises. *Procedia Economics and Finance*, 39, 668-673.
- Pyhrr, S., Roulac, S., & Born, W. (1999). Real estate cycles and their strategic implications for investors and portfolio managers in the global economy. *Journal of Real Estate Research*, 18(1), 7-68.
- Raftery, J. (1994). *Risk analysis in project management*. London: E & FN Spon.
- Saaty, T. L. (1980). *The analytic hierarchy process: Planning, priority setting, resource allocation*. London: McGraw-Hill.
- Saaty, T. L. (1986). Axiomatic foundation of the Analytic Hierarchy Process. *Management Science*, 32(7), 841-855.
- Saaty, T. L. (1990). An exposition of the AHP in reply to the paper 'Remarks on the Analytic Hierarchy Process'. *Management Science*, 36(3), 259-268.
- Saaty, T. L. (1994). How to make a decision: The analytic hierarchy process. *Interfaces*, 24(6), 19-43.
- Saaty, T. L. (1996). *Decision making with dependence and feedback: The analytic network process*. Pittsburgh, PA: RWS Publications.
- Saaty, T. L., & Vargas, L. G. (1991). *Prediction, projection and forecasting*. Boston, MA: Kluwer Academic.
- Saaty, T. L., & Vargas, L. G. (2006). *Decision making with the Analytic Network Process: Economic, political, social and technological applications with benefits, opportunities, costs and risks*. New York, NY: Springer.
- Sagalyn, L. (1990). Real estate risk and the business cycle: Evidence from security markets. *Journal of Real Estate Research*, 5(2), 203-219.
- Sanchaniya, R. J. (2021). The effect of Covid-19 on the real estate industry in India. *Baltic Journal of Real Estate Economics and Construction Management*, 9(1), 122-129.
- Sharma, M. J., Moon, I., & Bae, H. (2008). Analytic hierarchy process to assess and optimize distribution network. *Applied Mathematics and Computation*, 202(1), 256-265.
- Si, S.-L., You, X.-Y., Liu, H.-C., & Zhang P. (2018). DEMATEL technique: A systematic review of the state-of-the-art literature on methodologies and applications. *Mathematical Problems in Engineering*, 2018, Article 3696457.
- Simon, M., Houghton, S. M., & Aquino, K. (2000). Cognitive biases, risk perception, and venture formation: How individuals decide to start companies. *Journal of Business Venturing*, 15(2), 113-134.
- Sitkin, S. B., & Pablo, A. L. (1992). Reconceptualizing the determinants of risk behavior. *Academy of Management Review*, 17(1), 9-38.
- Smith, N. J., Merna, T., & Jobling, P. (2006). *Managing risk in construction projects* (2nd ed.). Malden, MA: Balckwell Publishing.
- Tanrıvermiş, H. (2020). Possible impacts of COVID-19 outbreak on real estate sector and possible changes to adopt: A situation analysis and general assessment on Turkish perspective. *Journal of Urban Management*, 9(3), 263-269.
- Thilini, M., & Wickramaarachchi, N. C. (2019). Risk assessment in commercial real estate development: An application of analytic network process. *Journal of Property Investment & Finance*, 37(5), 427-444.
- Uchehara, I., Hama-adama, M., Obiri, K. A., Jafarifar, N., & Moore, D. (2020). Impacts and risk management of COVID-19 pandemic on real estate supply chain. *International Journal of Real Estate Studies*, 14(S1), 41-53.
- Urban Development Institute of Australia (UDIA). (2003). The development industry – NSW's engine room. *Developers Digest*, 3, 12-13.
- Udoudoh, F. P. (2020). Risks management in real estate development. *PM World Journal*, 9(7), 1-15.
- Uher, T. E., & Toakley, A. R. (1999). Risk management in the conceptual phase of a project. *International Journal of Project Management*, 17(3), 161-169.
- United Nations Conference on Trade and Development (UNCTAD). (2020). *Word investment report 2020: International production beyond the pandemic*. New York, NY: United Nations Publications. Retrieved from <https://unctad.org/webflyer/world-investment-report-2020>
- United Nations Environment Programme (UNEP). (2007). *Buildings and climate change: Status, challenges and opportunities*. Nairobi: United Nations.
- Wang, Z., & Tang, K. (2020). Combating COVID-19: Health equity matters. *Nature Medicine*, 26, 458.
- Watkins, J. C., Hughes, S. C., Sims, R., II., Hildebran, M. E., & Hoyer, B. D. (2004). Assessing commercial real estate portfolio risk. *Supervisory Insights*, (Summer), 26-31. Retrieved from <https://www.fdic.gov/regulations/examinations/supervisory/insights/sisum04/sisummer04-article4.pdf>
- Whipple, R. T. M. (1988). Evaluating development projects. *Journal of Valuation*, 6(3), 253-286.
- Yüksel, İ., & Dağdeviren, M. (2007). Using the analytic network process (ANP) in a SWOT analysis – A case study for a textile firm. *Information Sciences*, 177(16), 3364-3382.
- Zainudeen, N., & Jeyamathan, J. (2008). Qualitative risk analysis framework for office developments. *Built-Environment – Sri Lanka*, 8(2), 32-40.

APPENDIX

Table A Judgments of alternative development plans for AHP evaluation
(Source: Authors' compilation)

Sub Criteria	Valuation Methods	Project A	Project B	Project C
2.1. Climate changes	Developer's satisfaction to local workforce market level (%)	60%	30%	40%
2.2. Impact of natural disasters	Level of benefits to local communities (%)	60%	30%	40%
3.1. Workforce availability	Business & lifestyle harmony level (%)	30%	25%	30%
3.2. Cultural compatibility	Impacts on local public health & safety (%)	80%	90%	80%
3.3. Community acceptability	Difficulties in site preparation for each specific plan (%)	80%	85%	75%
3.4. Public hygiene	Developer' satisfaction of their performances level (%)	25%	20%	25%
4.1. Interest Rate	Multiple use of the property level (%)	50%	70%	50%
4.2. Property type	Technical difficulties in construction level (%)	65%	60%	65%
4.3. Market liquidity	Total duration of the design and construction per 1,000 days (%)	70%	70%	70%
4.4. Confidence to the market	Possibility of amendments in design and construction (%)	15%	30%	15%
4.5. Demand and supply	Level of complexities in facilities management (%)	50%	60%	50%
4.6. Purchaseability	Level of easy access and quick emergency evacuation in use (%)	75%	55%	75%
4.7. Brand visibility	Refurbishment requirements during buildings lifecycle probability (%)	85%	80%	85%
4.8. Capital exposure	The overall Environmental Impacts Index value	95%	80%	90%
4.9. Lifecycle value	Level of impacts on use and value due to regional climatic variation (%)	12.5%	20%	12.5%
4.10. Area accessibility	Level of impacts due to natural disaster	75%	75%	75%
4.11. Buyers	Level of impacts due to the increase of loan rate (%)	75%	70%	65%
4.12. Tenants	Level of location concentration (%)	95%	95%	95%
4.13. Investment return	Selling rate of same kind of properties in the local market (%)	20%	25%	15%
4.14. Currency conversion	Confidence level of the developer	20%	25%	20%
4.15. Scarcity of land	Level of regional competitiveness (%)	40%	40%	30%
4.16. Variations of the land prices	Level of affordability to the same kind of properties (%)	35%	35%	30%
5.1. Site condition	Degree of developer's reputation in specific development (%)	30%	20%	30%
5.2. Designers and constructors	Rate of estimated lifecycle cost per 1 billion pounds (%)	75%	70%	75%
5.3. Multiple functionality	5-year property depreciation rate (%)	25%	20%	25%
5.4. Constructability	Level of regional infrastructures usability (%)	35%	40%	35%
5.5. Duration	Expected selling rate (%)	176%	125%	140%
5.6. Amendments	Expected annual lease rate (%)	30%	30%	30%
5.7. Facilities management	Expected capitalization rate (%)	85%	80%	85%
5.8. Accessibility and evacuation	Level of impacts due to exchange rate fluctuation	60%	50%	60%
5.9. Durability	Level of availability to finding suitable Land for the development (%)	20%	20%	20%
6.1. Political groups/activists	Level of impact to development cost due to land prices fluctuation (%)	25%	25%	25%
6.2. Commercial Tax policy and Local Tax policy	Level of protest by the urban communities (%)	20%	20%	20%
6.3. Council Approval/License Approval	Rate of Commercial Tax impact (%) Rate of Council Local Tax (%)	90%	80%	90%
7.1 Impacts of COVID-19 virus	Total Days of construction, design approval process by Liverpool City Council (LCC) Total Days of the license approval process	70%	80%	85%