

# A Risk-Adjusted Patent Valuation Framework for Real Estate Innovations in Malaysian Universities

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## ABSTRACT

The valuation of patents has become a critical concern for universities seeking to commercialize research outputs and enhance their contribution to national innovation systems. This challenge is particularly pronounced in the real estate sector, where technological innovations such as smart building systems, sustainable construction methods, and digital property management solutions are subject to heightened uncertainty, regulatory complexity, and market volatility. Existing patent valuation approaches—primarily cost-, market-, and income-based methods—were largely developed for industries with predictable commercialization pathways and therefore struggle to capture the unique risk profile of real estate-related patents generated within academic institutions.

This study proposes a **risk-adjusted patent valuation framework** tailored to real estate innovations originating from Malaysian universities. Drawing on intellectual capital theory and a structured analysis of market, technological, regulatory, and commercialization capability risks, the framework embeds risk directly into valuation logic rather than treating it as a post hoc adjustment. The framework advances existing valuation practices by aligning valuation mechanisms with sector-specific realities and institutional conditions.

The contribution of this paper is threefold. First, it extends the intellectual capital literature by theorizing risk as a structural dimension of patent valuation. Second, it offers a methodological contribution through a risk-embedded valuation framework suitable for university-generated patents. Third, it provides contextual insights from Malaysia, an underrepresented setting in patent valuation research. The framework supports more informed commercialization strategies and strengthens the strategic role of universities in real estate innovation.

**Keywords:** patent valuation; intellectual capital; real estate innovation; risk-adjusted valuation; universities; Malaysia

## INTRODUCTION

Universities play a central role in contemporary innovation ecosystems by generating intellectual property through research and development activities. Among the various forms of intellectual property, patents represent a critical mechanism through which academic knowledge can be transformed into economic and societal value. In Malaysia, national innovation policies increasingly emphasize university commercialization as a pathway toward a knowledge-based economy. Despite these efforts, the commercialization performance of university-generated patents remains uneven, particularly in complex sectors such as real estate.

The real estate sector has experienced significant transformation driven by technological innovations, including smart building systems, sustainable construction technologies, and digital property management platforms.

Many of these innovations originate from university research; however, their valuation is complicated by long development cycles, regulatory oversight, and uncertain market adoption. Conventional patent valuation methods were not designed for such contexts and often fail to reflect the true economic potential of real estate-related patents.

This paper argues that risk must be treated as a structural component of patent valuation rather than a peripheral adjustment. Accordingly, the study proposes a risk-adjusted patent valuation framework specifically designed for real estate innovations generated by Malaysian universities. The framework integrates multiple risk dimensions into valuation logic and positions valuation as a strategic tool for intellectual capital management.

## **PATENT VALUATION AND INTELLECTUAL CAPITAL IN UNIVERSITIES**

Patents are widely recognized as a core element of structural capital within intellectual capital theory. In universities, patents serve as mechanisms for institutionalizing knowledge and enabling commercialization. However, their value is contingent upon contextual factors such as market demand, regulatory conditions, and organizational capability.

Conventional valuation approaches—the cost, market, and income methods—remain dominant in practice. Yet each exhibits limitations when applied to university-generated patents, particularly in real estate. The cost approach neglects future value creation, the market approach suffers from limited comparables, and the income approach relies on speculative revenue projections. These limitations are exacerbated in real estate innovation due to regulatory complexity and long commercialization horizons.

The literature reveals a gap in valuation models that systematically integrate risk and uncertainty, particularly for university-generated patents in sector-specific contexts. This study addresses this gap by advancing a risk-embedded valuation perspective grounded in intellectual capital theory.

## **RISK AND UNCERTAINTY IN REAL ESTATE PATENT VALUATION**

University-generated patents in real estate are exposed to multiple, interacting risks. Market risk arises from cyclical property demand and macroeconomic sensitivity. Technological risk reflects uncertainty related to scalability, integration, and obsolescence. Regulatory risk stems from zoning laws, building codes, and policy changes. Commercialization capability risk reflects institutional capacity to transfer technology effectively.

These risks fundamentally shape the feasibility and magnitude of value realization. Treating them as external or secondary considerations results in valuation outcomes that are misaligned with actual commercialization potential. This study therefore conceptualizes risk as an intrinsic component of valuation logic.

Table 1 summarizes the key risk dimensions identified in this study and their implications for patent valuation

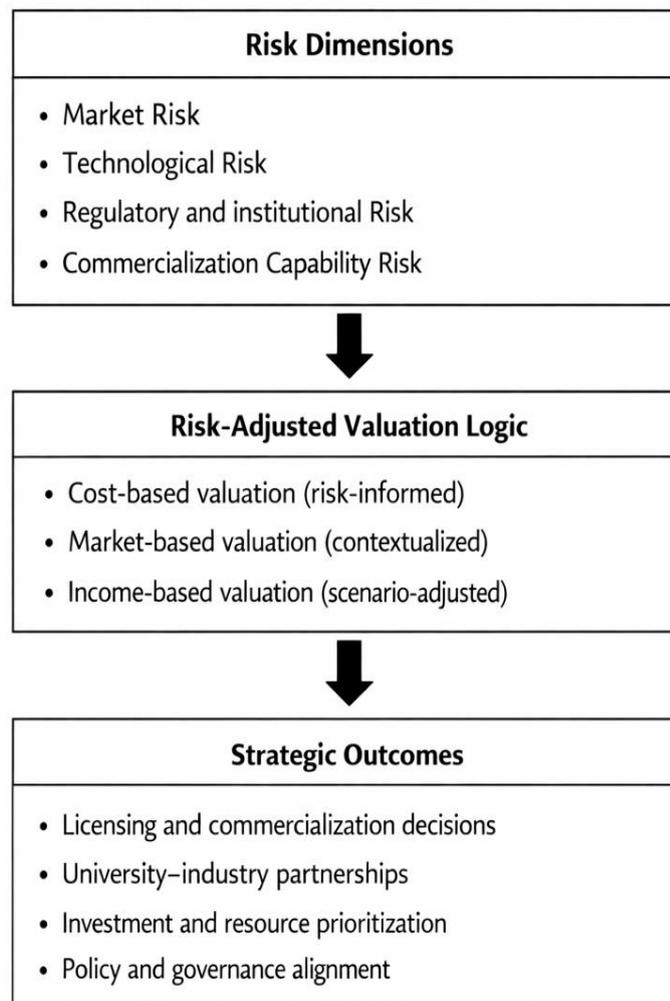
**Table 1. Key risk dimensions and valuation implications**

<b>Risk Dimension</b>	<b>Description</b>	<b>Valuation Implication</b>
Market Risk	Demand uncertainty and property market cycles	Adjust revenue projections
Technological Risk	Obsolescence and scalability challenges	Shorten economic life assumptions
Regulatory Risk	Planning approval and compliance requirements	Apply scenario-based valuation
Commercialization Risk	TTO capability and partner readiness	Use conservative valuation ranges

## CONCEPTUAL DEVELOPMENT OF THE RISK-ADJUSTED PATENT VALUATION FRAMEWORK

The proposed framework consists of three interconnected layers: **risk dimensions**, **valuation mechanisms**, and **strategic outcomes**. Risk dimensions are explicitly identified and assessed, valuation mechanisms are adjusted to reflect risk exposure, and valuation outputs are linked to strategic decisions such as licensing and partnership formation.

Rather than replacing existing valuation approaches, the framework enhances them by embedding structured risk assessment and scenario-based analysis. This approach acknowledges that patent value is context-dependent and dynamic, aligning valuation practice with intellectual capital theory.



**Figure 1.** Risk-adjusted patent valuation framework for real estate innovations in universities.

## IMPLICATIONS FOR UNIVERSITIES, INVESTORS, AND POLICYMAKERS

For universities, the framework supports strategic patent portfolio management and more realistic commercialization decisions. Technology transfer offices can differentiate patents based on risk profiles and tailor engagement strategies accordingly.

For investors and industry partners, the framework enhances transparency by clarifying assumptions and risk exposure, facilitating more balanced negotiations. Policymakers can use the framework to align innovation policy with valuation practices, particularly in regulated sectors such as real estate.

## CONCLUSION AND FUTURE RESEARCH AGENDA

This study proposes a risk-adjusted patent valuation framework tailored to real estate innovations generated by Malaysian universities. By embedding risk directly into valuation logic, the framework advances intellectual capital theory and addresses a critical gap in patent valuation research.

Future research may empirically test the framework using case studies or quantitative analysis and extend it to other sectors or national contexts. Integrating real options or probabilistic modelling represents a promising avenue for further development.

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