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Optimizing Information Technology Investment Using the Total Cost of Ownership (TCO) Approach: A Case Study of a Property Company

Tania Ayu Sekar Arum*, Lukman Abdurrahman
Universitas Telkom, Indonesia
Email: taniayusa@student.telkomuniversity.ac.id*, abdural@telkomuniversity.ac.id

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ABSTRACT

Information technology (IT) investment has become an essential component for improving operational efficiency, service quality, and business competitiveness in the property industry. However, many companies still focus only on initial acquisition costs without considering the overall expenses incurred throughout the lifecycle of IT assets. This study aims to evaluate and optimize IT investment at Ray White CBD Bandung using the Total Cost of Ownership (TCO) approach. The research employed a quantitative descriptive method using primary and secondary data collected through interviews, observation, and document analysis. The TCO approach was used to identify and calculate all IT-related costs, including acquisition, maintenance, support, and training costs during the 2022–2024 period. The findings reveal that software costs represented the largest component of IT investment, followed by equipment maintenance, printer assets, and employee training. The study also identified several hidden costs, such as downtime, vendor dependency, and troubleshooting time, which significantly influenced operational efficiency and financial performance. The implementation of the TCO approach helped the company understand the real cost structure of IT ownership and improve budget planning. In conclusion, the TCO approach provides a comprehensive framework for making strategic, sustainable, and cost-effective IT investment decisions in property companies.

INTRODUCTION

Increasing the performance and competitiveness of companies across a range of industries, including real estate, requires investing in information technology (IT). IT can improve customer service quality, increase productivity, and improve business operations when used appropriately (Petrošiene & Ivanauskiene, 2019; Scheidt & Chung, 2019). However, the complexity of IT systems and the speed at which technology is developing often lead to higher investment costs that are not fully understood at the outset, which can lead to waste and less-than-ideal investment decisions (Chesbrough & Tucci, 2020; Pant et al., 2023; Reis et al., 2022).

The Total Cost of Ownership (TCO) approach considers all costs associated with the acquisition, implementation, operation, maintenance, and replacement of IT assets in order to evaluate IT investments. Businesses can find hidden costs and develop a more rational, data-

driven IT investment plan by employing this technique. Previous studies have shown that TCO implementation can improve cost management effectiveness in the context of cloud computing and information system outsourcing strategies by helping businesses better understand the cost structure. Although the TCO approach has been widely used in the manufacturing, finance, and IT sectors, research on its application in the real estate sector is still relatively limited. Some of the distinctive characteristics of the real estate industry include geographically dispersed asset management, a strong dependence on information systems for property management and customer service, and the need for sustained IT investment (Munawar et al., 2020; Ullah et al., 2018; Zhao & Graham, 2026). This situation makes evaluating IT investment in the real estate sector more difficult and calls for a comprehensive analytical approach (Bozorgi, 2015; Mantogiannis & Katsigiannis, 2020).

Ray White CBD Bandung, one of the leading real estate companies in Indonesia, depends significantly on IT to support its operational and business services. A variety of IT systems are used, such as property management software, client communication platforms, and integrated data management (Dai, 2020; Ma, 2021). The largest challenge facing businesses is how to effectively manage IT investments to control costs without compromising operational effectiveness and service quality (Abdallah et al., 2016; Chen et al., 2021; Wirtz, 2020).

Most previous research was either theoretical or relied on secondary data, which prevented it from providing a comprehensive picture of the application of TCO in a specific company. Therefore, the goal of this study is to assess and optimize IT investment in Ray White CBD Bandung using the Total Cost of Ownership (TCO) approach. Apart from calculating the overall cost of IT ownership, the study evaluates its impact on business performance in terms of improved service quality, increased operational effectiveness, and overall financial impact. It is anticipated that the research's findings will contribute both theoretically and practically to the advancement of IT investment studies in the real estate sector, as well as offer data-based suggestions that the management of the company can immediately implement.

However, the rapid adoption of information technology also creates new managerial challenges, particularly in controlling investment costs. Many companies still evaluate IT investment only from the initial purchase price, while other costs such as maintenance, training, technical support, system downtime, software renewal, hardware replacement, and security risks are often overlooked. This condition can cause hidden costs to accumulate and reduce the actual value of IT investment. Therefore, companies need a comprehensive approach that can calculate the entire cost structure of technology ownership throughout its lifecycle.

The Total Cost of Ownership approach offers a relevant framework to address this issue because it does not only calculate acquisition costs, but also includes operational, maintenance, support, training, and disposal costs. Through TCO analysis, companies can understand the real financial burden of IT assets and make more rational investment decisions. This approach is particularly important for service-based companies such as real estate firms because technology performance directly affects service quality, employee productivity, and customer satisfaction. By using TCO, management can identify inefficient spending patterns and determine which IT assets should be maintained, upgraded, replaced, or optimized.

Previous studies have shown that TCO is useful for supporting strategic cost management and investment decision-making. Ellram explained that TCO helps organizations understand all relevant costs related to acquisition, use, maintenance, and disposal. Lizot et al. also

emphasized that integrating TCO with decision-making models can improve cost management because it considers both monetary and non-monetary factors. Meanwhile, studies on IT and industrial investment contexts show that TCO is effective in revealing hidden costs and supporting long-term investment evaluation. These findings demonstrate that TCO is not only a financial calculation tool, but also a strategic management instrument.

Although TCO has been widely discussed in manufacturing, procurement, transportation, and technology-related industries, its application in the property sector remains relatively limited. Real estate companies have specific operational characteristics, such as dispersed property data management, intensive client communication, digital marketing needs, administrative documentation, and dependence on property management systems. These characteristics make IT investment in property companies different from investment in other sectors. Therefore, further research is needed to examine how TCO can be applied in a real estate company context, especially in identifying visible and hidden IT costs.

Ray White CBD Bandung provides a relevant case for examining this issue because the company relies on information technology to support daily business operations, property management, customer service, communication systems, and internal administration. The manuscript shows that the company has several IT cost components, including software costs, equipment maintenance, printer assets and maintenance, technical support, and IT training. During the 2022–2024 period, software became the largest cost component, while maintenance and training also contributed to the total cost structure. This condition indicates that IT investment in the company is not limited to procurement, but continues throughout the lifecycle of technology use.

The main research gap lies in the limited empirical analysis of TCO implementation in property companies, particularly studies based on direct company data. Many previous studies tend to discuss TCO conceptually or apply it in sectors outside real estate. In addition, hidden costs such as staff time for troubleshooting, dependence on external vendors, system disruption, and security risks are often not systematically recorded in company financial reports. This study addresses that gap by analyzing IT investment costs at Ray White CBD Bandung using the TCO approach and by connecting the cost structure with operational efficiency, service quality, and financial performance.

The urgency of this research is based on the need for property companies to manage IT investment more efficiently without reducing service quality and operational performance. In a competitive real estate market, poor IT planning can increase costs, disrupt services, reduce employee productivity, and weaken customer trust. Conversely, well-planned IT investment can support faster service delivery, better data management, and more accurate managerial decisions. Therefore, this research is important because it provides a practical framework for companies to evaluate IT spending transparently and to develop more sustainable technology investment strategies.

The novelty of this research lies in its application of the TCO approach to evaluate IT investment in a property company using direct evidence from Ray White CBD Bandung. This study aims to identify and quantify IT cost components, analyze hidden costs, and assess how IT investment supports operational efficiency, service quality, and financial performance. The contribution of this research is both theoretical and practical. Theoretically, it enriches studies on TCO implementation in the real estate sector. Practically, it provides management with data-

based recommendations for optimizing IT investment, improving budget planning, reducing unnecessary costs, and strengthening long-term technology governance.

METHOD

The Total Cost of Ownership (TCO) analysis method was used in this study's quantitative approach to assess and enhance information technology investment. Ray White CBD Bandung, a real estate company that depends on information technology to run its business, is the subject of the study. The nature of the property industry, which has complicated operating and maintenance costs and requires long-term planning for information technology investments, is reflected in the choice of research topic.

Primary data and some secondary data were combined in this study. I believe that the main source was first-hand observation and those scheduled interviews with the company's IT management personnel. The secondary data was taken from IT-related financial reports and internal company documents, as well as a few relevant books and articles. We first determined the primary issue before researching relevant literature to develop a strong theoretical foundation for selecting techniques. Keeping everything on course seems to depend on that. Following that, data collection affected every aspect of IT costs, including purchasing new equipment, managing day-to-day operations, repairing and maintaining equipment, and even the expenses associated with replacing or discarding outdated assets. Although they cover the fundamentals, some of those cost breakdowns seem to overlap a little. Although the observation helped identify things that interviews might miss, it is unclear how much each component ultimately weighed.

The goal of this study is to assist Ray White CBD Bandung in managing their IT investments in a few useful ways. To calculate the total costs associated with IT over the course of the assets' lifecycle, we took the collected data and applied the Total Cost of Ownership method, or TCO. It detects both direct and indirect costs as well as those hidden expenses that conventional methods of computation occasionally fail to account for. We can draw conclusions and offer some suggestions for businesses on how to control IT expenditures and determine optimization tactics based on the analysis's findings. That section, in my opinion, is particularly noteworthy since it refers to actual choices. This seems like it might also have an academic impact and serve as a model for future research examining TCO's operations in the real estate industry or other industries. Although not everything is finished there, it appears to be helpful for things in the future.

A. Data Source

1. Interview: This method is used to collect direct primary data so that researchers can gain direct insights from stakeholders on how Ray White CBD Bandung company manages their IT.
2. Observation: Observe firsthand the IT management process in a property company to gain a first-hand understanding of the day-to-day operations and use of IT.
3. Document Analysis: Collect and analyze relevant company documents, such as financial statements, IT reports, and strategic planning documents to understand IT cost allocation and investment

B. Data Analysis

In this study, the analysis was carried out with the following steps:

1. Identify IT cost components based on TCO classification
2. Calculate the total cost for each component in the period 2022–2024.
3. Expense efficiency analysis based on the ratio between maintenance costs and acquisition costs.
4. An evaluation of hidden costs that are often not explicitly recorded.
5. Interpretation of observational and interview data to support quantitative results.

The components analyzed include:

a. Acquisition Cost: The purchase of hardware, software, and other IT infrastructure.

Table 1 Acquisition Cost

Date	Remarks	Item Type	Cost (Rp)
10 Nov 2023	Printer Purchase	Aset Tetap	3.105.000
14 Nov 2024	Printer Purchase	Aset Tetap	2.481.600
Total			**5.586.600**

Source: Internal Company Asset Procurement Data (2023–2024).

The purchase of new printers indicates the strengthening of IT infrastructure in the office. This value is relatively large because it is included in fixed assets that are used in the long term. These costs are critical as an initial part of an IT investment.

b. Operational Cost: Electricity costs, internet connection, device upgrades, and daily use.

Maintenance Cost: The cost of servicing the device, repairing the device, and replacing parts.

Table 2 Maintenance Cost

Year	Key Maintenance Components	Cost (Rp)
2022	Computer Service, upgrade RAM, LCD HP, printer, etc.	1.942.875
2022	Extras: reconfiguration, repair 3 PCs, spare part	2.000.000
2023	Computer and printer service, maintenance PC	1.872.500
2024	Setting service, antivirus, update printer & spare part	3.289.102
Total		**8.106.477**

Source: Internal IT Maintenance Records (2022–2024).

Maintenance costs have increased year by year, which indicates that the frequency of maintenance is quite high. This can be an indicator that an IT device needs special attention or that it needs regular system updates to make it more efficient.

c. **Training Cost**: The cost of training and skill development of IT user staff.

Table 3 Training Cost

Year	Training Type	Cost (Rp)
2022	Training Fave Hotel, Seminar R123	1.675.000
2022	Training IT Support	675.000
2024	Webinar and Training IT Support	575.000
Total		**2.925.000**

Source: Internal IT Training and Seminar Records (2022–2024).

Investment in training is important to ensure that staff are able to use IT systems to the fullest. The cost of this training is still within a reasonable range and can be increased to compensate for the increased complexity of the systems used.

Support *Cost*: Third-party setup, system configuration, and technical support services.

Table 4 Support Cost

Date	Remarks	Cost (Rp)
26 Jan 2024	Computer Service Setting & Printer	350.000
26 Jan 2024	Antivirus Kaspersky	250.000
26 Jan 2024	Switch LAN & Wifi Adapter	250.000
Total		**850.000**

Source: Internal Technical Support Expenditure Data (2024).

RESULT AND DISCUSSION

A. Identification and analysis of cost components involved in information technology investment in Ray White CBD Bandung using the Total Cost of Ownership (TCO) approach

In managing information technology (IT) investments, Ray White CBD Bandung conducts a thorough identification and analysis process of all related cost components. This study uses the Total Cost of Ownership (TCO) approach as an analytical framework to map the costs incurred, both direct and indirect, related to information technology investment. This approach aims to provide a comprehensive picture of the total cost burden that companies must bear during the life cycle of the use of information technology, not limited to the initial cost of procurement alone.

Based on the results of interviews with internal company parties, several important information was obtained related to the process of recording and classifying IT costs, as stated by the informant:

"We record all expenses from hardware purchases, software, training, to maintenance and technical support. Although we have not formally used TCO, we have considered various direct and indirect costs in IT management. Each cost is recorded and classified in detail, and separated between capital expenditure (capex) and operational expenditure (opex)."

Table 5 Total cost of Ownership (TCO)

TI Cost Component	Tahun	Nilai (Rp)
TCO Cost Software	2022	36.684.400
	2023	41.292.000
	2024	38.131.600
Total TCO Software		**116.108.000**
TCO Equipment Maintenance	2022	3.247.875
	2023	1.872.500
	2024	2.839.102
Total TCO		**7.959.477**
Total Assets (Purchases)		5.586.600

Total Maintenance	1.037.628
Total TCO Printer	**6.624.228**
TCO Training IT	
Training & Seminar 2022-2024	2.925.000

Source: Internal Technical Support Expenditure Data (2024).

With a total Total Cost of Ownership (TCO) of IDR 116,108,000 over the last three years, software costs are the largest component of information technology investment in Ray White CBD Bandung, according to the analysis results in the table. These results demonstrate that businesses prioritize software investments to support business operations, especially the use of property management software and Enterprise Resource Planning (ERP) systems.

In addition to software costs, maintaining IT equipment comes at a relatively high cost of IDR 7,959,477. This cost includes routine maintenance and repairs for hardware, such as PCs and printers, which are vital components that support daily operations. The cost of buying and maintaining printers was specifically determined to be IDR 6,624,228. This indicates that printers are still a strategic asset that requires constant management and care to guarantee reliability and operational performance. In addition to investments in hardware and software, the company has set aside IDR 2,925,000 for human resource development, specifically through information technology training activities. The effectiveness and efficiency of the business's operations are supported by investing in this training component, which is essential for improving employee competencies so they can operate and use IT systems as efficiently as possible.

B. The application of the TCO approach can help identify and manage hidden costs and optimize the information technology investment budget in Ray White CBD Bandung

In addition to obvious direct costs like buying software and hardware, the Total Cost of Ownership (TCO) method takes into account hidden costs that are often not explicitly mentioned in the company's financial statements. These hidden costs include things like staff time spent troubleshooting, the extent of reliance on outside vendors, potential security risks from delayed system updates, and downtime caused by device malfunctions.

Information technology management practices have so far focused on recording direct costs, while several indirect costs have not been fully identified and methodically documented, according to the results of an interview with the information technology team at Ray White CBD Bandung. The informant claims that these findings demonstrate the value of the TCO approach as an analytical tool that can provide a more comprehensive view of costs.

"Previously, costs such as staff time wasted on repairs or reliance on vendors were often not included in the budget calculation. Using TCO, we can see a complete picture of the entire cost, including costs that have not been seen so far. The TCO approach helps us plan budgets more realistically and prevent unexpected cost overruns, especially for maintenance and technical support."

By understanding and integrating these hidden costs into planning using the TCO approach, Ray White CBD Bandung can maximize IT budget management, reduce the risk of unanticipated cost overruns, and ensure that information technology investments yield maximum and long-lasting results.

C. Implementation strategy by Ray White CBD Bandung to reduce the total cost of information technology investment without sacrificing quality and operational performance

Ray White CBD Bandung is one of many companies that find it difficult to properly manage their information technology (IT) investments. Because the costs of operations, maintenance, procurement, and human resource development are so complex, businesses need a comprehensive analytical framework. In this case, the Total Cost of Ownership (TCO) approach is essential because it provides a thorough view of all related expenses, allowing companies to develop economical plans without sacrificing operational efficacy and quality. The results of the interview with the IT team at Ray White CBD Bandung are used to create an outline of the IT investment management strategy that the company has employed and can employ. As stated by one of the informants:

"We strive to improve maintenance efficiency by using automatic monitoring software, so that potential damage can be detected early without having to wait for real disturbances. In addition, investment in in-house training reduces reliance on external vendors, so technical support costs can be reduced."

According to the results of the interviews, the company has begun to adopt a TCO-aligned strategy, particularly in an effort to lower hidden costs and improve operational efficiency.

The Total Cost of Ownership (TCO) approach is used to assess Ray White CBD Bandung's information technology investments in order to obtain a comprehensive picture of all costs incurred throughout the technology life cycle, including initial procurement costs as well as long-term and indirect costs. This approach emphasizes that when making investment decisions, one should consider the cost of maintenance, training, technical support, software licensing, potential losses from downtime, and security risks. As demonstrated by the use of cost recording that distinguishes between capital expenditure (CapEx) and operational expenditure (OpEx) and the identification of indirect costs, the TCO approach is applicable when evaluating the sustainability and efficacy of an organization's information technology investment.

The application of the Total Cost of Ownership (TCO) approach in information technology investment management has a substantial impact on the planning, management, and evaluation of an organization's IT budget. System outages, reliance on external vendors, and low productivity due to a lack of user competencies are just a few examples of waste and inefficiencies that can be detected early thanks to this strategy, which increases the company's awareness of the importance of accounting for all investment costs, including hidden costs that were previously commonly ignored. Furthermore, TCO is promoting a change in perspective in the way that investments are made, moving away from a short-term, price-based approach and toward a long-term value perspective that takes maintenance effectiveness, scalability, and technical support into account. From a managerial standpoint, this method leads to more practical and proactive budgeting practices, such as setting aside money for contingencies and incorporating training for human resources as a crucial component of the cycle of information technology investments.

This study is closely related to earlier research that posits the Total Cost of Ownership (TCO) approach as a crucial conceptual framework for investment decision-making, particularly in industries with a high degree of information technology dependence. The TCO approach encompasses all cost components over the asset lifecycle, including hidden costs like user training, system maintenance, technical support, and possible damage and downtime risks. It is not just about calculating the initial cost. The results of this study demonstrate that, despite not having formally adopted a TCO approach, Ray White CBD Bandung has incorporated TCO principles into its management practices, such as tracking training and technical support expenses and keeping capital expenditures (CapEx) and operating expenditures (OpEx) separate.

Research by Pranata et al. (2023), which contrasts the investment efficiency of conventional and electric vehicles, further supports the applicability of the TCO approach. The study shows that investment decisions that only take the initial purchase price into account are unable to fairly represent the actual long-term costs. Decision-makers can identify additional cost factors that have a major impact on overall system effectiveness and total spending by using TCO. This is in line with the circumstances at Ray White CBD Bandung, where the use of hardware, ERP systems, and accounting software requires a long-term management plan in order to remain relevant to operational demands and effective, as well as relatively high maintenance and training costs (Pranata et al., 2023).

Furthermore, according to Ekawati & Aditya (2018) on the evaluation of raw material suppliers, the TCO approach is essential for assessing long-term performance rather than just short-term efficiency. This viewpoint is pertinent to the requirements of businesses like Ray White CBD Bandung, which have to take into account a number of alternative technology suppliers for both hardware and software and assess the caliber of technical services by adding up all of the expenses incurred over the course of using these services (Ekawati & Aditya, 2018).

The study by Stroparo & Floriani (2024), which connects the TCO approach to the accomplishment of the Sustainable Development Goals (SDGs), suggests a more comprehensive aspect of TCO implementation. In addition to optimizing the budget, the TCO approach is thought to promote waste reduction, efficient resource use, and more environmentally and socially conscious decision-making. The comparatively minimal usage of cloud-based systems and subscription software in Ray White CBD Bandung represents the first step toward a technology strategy that is more resource-sustainable, scalable, and energy-efficient (Stroparo & Floriani, 2024).

A systematic review by Panjaitan et al. (2024) also confirmed the significance of integrating multiple factors in TCO evaluation, demonstrating that in order to obtain a comprehensive picture of investment costs, factors such as technological reliability, training duration, and technical support needs should be taken into consideration. This supports the study's conclusions that the management of Ray White CBD Bandung's IT infrastructure must take into account hidden costs like system outages, staff time spent troubleshooting, and security threats brought on by subpar antivirus software (Panjaitan et al., 2024).

Suttakul et al.'s (2022) study comparing the TCO of electric and fossil fuel vehicles also emphasizes the importance of simulations and long-term cost projections to avoid unforeseen expenses. The outcomes are in line with Ray White CBD Bandung's policy, which has started

allocating a 10–15% yearly budget cushion to cover unanticipated costs such as additional licensing requirements or system modifications. This tactic shows that the management of the organization has realized the importance of more precise cost estimates in information technology financial planning (Suttakul et al., 2022).

Furthermore, a life cycle cost-based approach can offer a deeper understanding of operational efficiency while supporting sustainability principles, as demonstrated by Jedliň & Sowa's (2021) study on the application of TCO on recycled wood pallets. The approach taken by Ray White CBD Bandung, which aims to preserve information technology's operational performance without imposing undue financial strains over time, reflects a similar viewpoint (Jedliň & Sowa, 2021).

This research has both academic and practical significance because it expands the application of the TCO approach into the real estate and service sectors, which are still relatively understudied. The study's conclusions not only theoretically validate the TCO approach's validity but also show that it can be applied gradually and measurably. This study is expected to serve as a guide for other companies in related industries looking to apply the TCO approach as a strategic and evaluative tool to more effectively and efficiently manage IT investments.

CONCLUSION

A comprehensive analytical framework for evaluating information technology investments is provided to PT XYZ by the use of the Total Cost of Ownership (TCO) approach, which accounts for all costs incurred during the system lifecycle, both direct and indirect. The identification results show that the company's IT investments include software costs, printer assets and maintenance, equipment maintenance, and human resource training. The largest expense during the 2022–2024 period was that of software components. Even though the TCO approach has not been formally implemented, the company's financial management practices have reflected most of the TCO principles, such as the distinction between capital expenditure (CapEx) and operational expenditure (OpEx), as well as the recording of training costs and technical support. The use of TCO is proving crucial in locating hidden expenses that have a big influence on the effectiveness of investments, like system outages, dependence on outside vendors, and unforeseen training. The TCO approach not only makes it possible to evaluate investments using the total value of ownership, but it also pushes businesses to adopt cloud-based solutions, standardize systems, improve internal HR competencies, conduct periodic vendor evaluations, and use lifecycle-based asset management to create more effective IT management strategies. All things considered, the TCO approach supports more strategic information technology investment decisions by assisting businesses in creating more long-term, sustainable, and realistic value-based budget planning.

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