

Technology Acceptance for Machine Learning Decision Model in the Health Insurance System

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This research investigates technology acceptance for a machine learning (ML) decision model in the health insurance system. Focusing on claim adjusters' perceptions, the study examines how perceived usefulness and ease of use of the ML model influence their attitudes and ultimately their adoption of the technology. Data collected through a Likert scale questionnaire reveals high overall satisfaction with perceived ease of use. Perceived usefulness achieved moderate to high satisfaction, and the attitude towards use indicated strong interest. These findings suggest that an ML-based health claim consideration system may be a valuable tool to support claim adjusters.

Keywords: Technology Acceptance, Machine Learning, Health Insurance.

1. Introduction

The global healthcare system grapples with a pressing challenge: escalating medical expenses. Out-of-pocket expenditures have steadily increased, averaging 5.49% annually over the past two decades [1-5]. This trend is driven by advancements in medical technology, an aging population, and the growing prevalence of chronic diseases [6-9]. Thailand, like many nations, experiences the direct impact of these public health issues on its citizens' well-being.

While Thailand boasts three major health insurance systems – the Civil Servant Medical Benefit Scheme (CSMBS), the Social Security Scheme (SSS), and the Universal Coverage Scheme (UCS) [10-12] – these programs may not fully address the needs of all demographic groups. Consequently, individuals often face out-of-pocket hospitalization costs. Voluntary health insurance emerges as a potential solution, allowing patients to mitigate the financial

burden of unexpected or significant medical expenses [13-15].

However, existing health claim assessment procedures in Thailand are not without limitations. Challenges such as fraud, errors, and delays continue to hinder the process, potentially impacting both efficiency and accuracy. This research investigates the potential of machine learning (ML) to address these shortcomings.

Current health claim assessment methods often rely on manual review processes, which are susceptible to human error and inefficiencies. While advancements in medical technology contribute to improved patient care, they can also complicate the claim assessment process due to the increasing complexity of medical procedures and diagnoses. Limited research explores the application of ML models to support claim reviewers in the Thai health insurance context.

This research aims to bridge this gap by investigating the acceptance of a machine learning decision model designed to assist claim reviewers in approving medical expenses. The core focus lies in understanding how claim adjusters perceive the model's usefulness and ease of use. By examining these perceptions, the study aims to assess how they influence the adjusters' attitudes towards adopting this technology. A Likert scale questionnaire serves as the primary tool for data collection.

The overarching objective is to explore the feasibility of developing a system that utilizes ML to support and potentially augment claim adjusters' work. This system has the potential to enhance efficiency and accuracy within the Thai health insurance system, ultimately benefiting both patients and healthcare providers by reducing processing times and minimizing errors.

2. Literature Review

2.1 Diffusion of Innovations

Everett Rogers' (1962) seminal work, *Diffusion of Innovations* [16], proposes a framework for understanding how innovations spread within a social system. He identifies five adopter categories:

- **Innovators (2.5%):** The first to embrace new ideas, comfortable with risk and uncertainty.
- **Early Adopters (13.5%):** Opinion leaders who adopt innovations after initial uncertainty subsides. Their acceptance influences later adopters.
- **Early Majority (34%):** More cautious, they require time to evaluate innovations before adoption.
- **Late Majority (34%):** Susceptible to social pressure, they adopt innovations only after widespread acceptance.
- **Laggards (16%):** The most resistant to change, often due to lack of interest or resources.

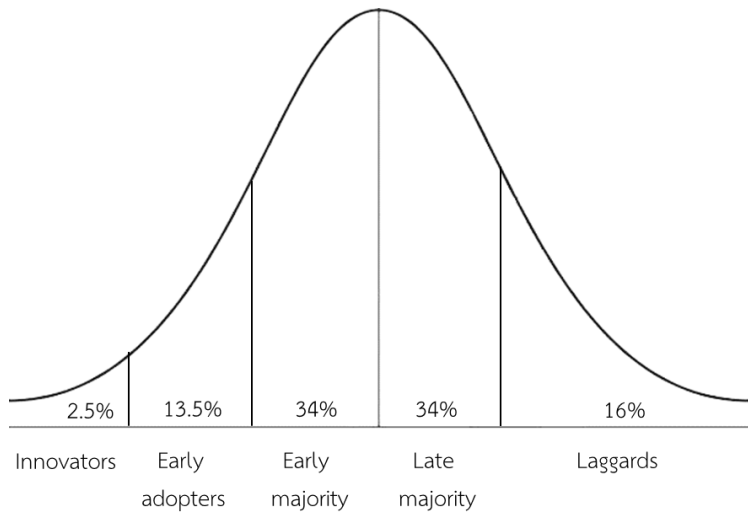


Figure 1 Roger's innovation adoption curve

Factors Influencing Innovation Diffusion

Rogers highlights several key factors that impact the spread of innovations:

- **Innovation Characteristics:**
 - **Relative Advantage:** Perceived superiority of the innovation over existing practices.
 - **Compatibility:** Alignment with existing experiences and workflows.
 - **Complexity:** Ease of understanding and use.
 - **Trialability:** The ability to experiment with the innovation on a limited scale.
 - **Observability:** The degree to which the innovation's results are visible.
- **Communication Channels:**
 - **Mass Media:** Effective for creating awareness about innovations.
 - **Interpersonal Communication:** Plays a crucial role in shaping attitudes towards new ideas.
- **Time:**
 - **Innovation Decision Process:** Stages involved in considering and adopting an innovation.
 - **Innovativeness:** The tendency of individuals to embrace new ideas readily.
 - **Rate of Adoption:** The speed at which an innovation is adopted by a social system.

The Innovation-Decision Process

Rogers outlines a five-stage decision-making process for innovation adoption:

1. Knowledge: Recognition of the innovation's existence.
2. Persuasion: Development of interest and understanding of how the innovation addresses a need.
3. Evaluation: Assessment of the innovation's potential benefits and drawbacks.
4. Implementation: Putting the innovation into practice and adapting it for optimal use.
5. Confirmation: Seeking reinforcement for the adoption decision.

The diffusion of innovation theory provides a valuable framework for understanding technology adoption in healthcare. By considering factors like innovation characteristics, communication strategies, and the decision-making process, healthcare organizations can develop effective strategies to promote the uptake of new technologies and improve patient care.

2.2 The Technology Acceptance Model

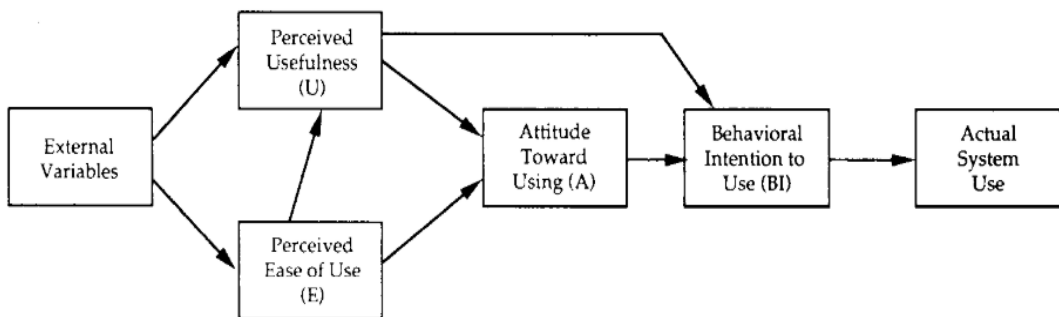


Figure 2 Technology Acceptance Model (TAM)

Davis et al. (1989) introduced the Technology Acceptance Model (TAM) [17], drawing upon Fishbein and Ajzen's Theory of Reasoned Action (TRA). TAM focuses on understanding the factors that influence user acceptance of technology or innovation. It identifies two primary determinants of technology adoption behavior:

Perceived Usefulness: Users' belief that adopting a technology will enhance their work performance.

Perceived Ease of Use: The degree to which users expect the technology to be effortless to use.

TAM posits that Perceived Usefulness and Perceived Ease of Use influence Attitude towards Use, which, in turn, affects Actual Use Behavior. Therefore, TAM assessments typically collect data on these three constructs to evaluate technology acceptance.

2.3 Applications of TAM in Healthcare

The Technology Acceptance Model (TAM) has garnered significant attention in healthcare research, particularly concerning technology adoption. Below are summaries of key studies that apply TAM in the context of health insurance and digital healthcare:

Several studies have contributed to understanding the acceptance of technological innovations in healthcare settings. One study conducted in Indonesia focused on investigating the adoption of a mobile health insurance application, utilizing the TAM framework [18]. This research aimed to elucidate the influence of perceived ease of use and perceived usefulness on user acceptance, examining users' perceptions of the application's usability and value in the context of health insurance. Similarly, another study explored the acceptance of digital healthcare services among older adults in South Korea [19]. By employing an extended TAM model, this research expanded upon the traditional framework to consider additional factors relevant to older adults' adoption of new digital healthcare options, given their potentially limited familiarity with technology. Additionally, a study conducted in Chennai, India, delved into the acceptance of a new outpatient information system within private hospital sectors, also utilizing the TAM model [20]. This research investigated how perceived ease of use and perceived usefulness influenced the adoption of the technology among hospital staff tasked with managing patient information. These studies collectively contribute to the literature by providing insights into various factors influencing the adoption of healthcare technologies, thereby informing strategies to enhance user acceptance and improve healthcare delivery.

In summary, these studies showcase the application of the TAM model to comprehend user acceptance of technology within health insurance and healthcare contexts. They shed light on how factors like ease of use and perceived benefits shape individuals' readiness to embrace new technologies.

TAM serves as a robust framework for elucidating and predicting technology adoption behavior in healthcare settings. Its simplicity and empirical foundation render it invaluable for both researchers and practitioners. However, it is essential to acknowledge TAM's limitations, including its failure to encompass all factors influencing technology adoption and its assumption of rational decision-making. Nonetheless, by considering the elements outlined in TAM, healthcare organizations can formulate effective strategies to promote the uptake of new technologies and enhance patient care.

3. Methodology

Questionnaire Development

The research employed a questionnaire developed based on the Technology Acceptance Model (TAM). The questionnaire was divided into three sections:

- Perceived Usefulness: Measures users' perceptions of the technology's benefits.
- Perceived Ease of Use: Assesses users' expectations regarding the ease of using the technology.
- Intention to Use: Gauges users' likelihood of adopting the technology.

Population and Sample

The target population for the survey was health claim assessors working in health insurance claim departments of insurance companies or third-party administrators (TPAs). These individuals represent the system's primary users. A purposive sampling approach was adopted to select a sample of 32 respondents with relevant expertise in outpatient claim review.

Data Collection

The questionnaire was administered online to the selected sample. Participants were also provided with a simulated system demonstration to facilitate their assessment of the technology.

Data Analysis

Data collected from the questionnaire was analyzed using the following methods:

- **Mean:** Calculated the average response for each item on the questionnaire.
- **Standard Deviation:** Assessed the variability of responses for each item.
- **Margin of Error:** Determined the range within which the true population mean falls with a 95% confidence level.
- **Confidence Interval:** Established the range of values within which the true population mean is likely to lie with a 95% confidence level.

Data Collection Procedure

Questionnaire Distribution

The online questionnaire was distributed to the selected sample of 32 health claim assessors via Google Form. Participants were provided with a link to the questionnaire and clear instructions for completing it.

System Demonstration

Before completing the questionnaire, participants were provided with a simulated demonstration of the claim assessment system. This demonstration aimed to familiarize participants with the system's features and functionality, allowing them to provide informed responses regarding their perceptions of its usefulness and ease of use.

4. Results

A total of 32 health claim assessors from insurance companies participated in the study. The average age of the participants was 34.31 years, and they had an average of 6.69 years of experience in the health insurance industry. The most common job title among the respondents was "Claims Officer," accounting for 37% (n=12) of the total sample.

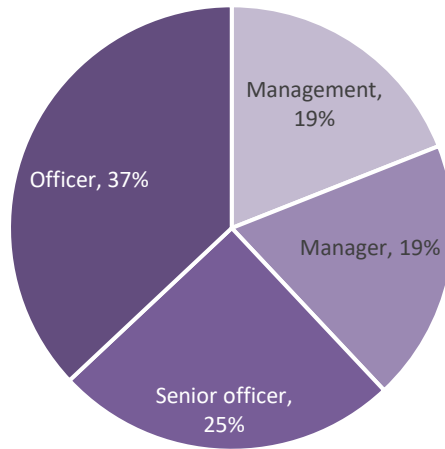


Figure 3 The job title among the respondents

To assess the level of technology acceptance among the participants, the researchers computed the mean, standard deviation, margin of error, and confidence interval (95% confidence level) for the technology acceptance evaluation data. The results are summarized in the following table:

Table 1 Result of Technology Acceptance among Health Claim Assessors.

Construct	Statistics				Opinion Level
	Mean	S.D.	Confidence Interval		
			Lower	Upper	
1. Perceived usefulness					
1.1 The system facilitates the determination of proper outpatient claim approval within the realm of health insurance.	3.4688	0.9499	3.1396	3.7979	Moderate to High
1.2 The system contributes to the reduction of the workload burdening health claim assessors.	3.9375	1.0453	3.5753	4.2997	High to Highest
1.3 The system diminishes the duration required for the health claim approval process.	4.0000	0.9504	3.6707	4.3293	High to Highest
1.4 The system enhances the assurance in assessing health claims.	3.5313	0.9499	3.2021	3.8604	Moderate to High
1.5 The system facilitates the augmentation of efficiency in the decision-making process concerning the approval of health claims.	3.5938	0.9791	3.2545	3.9330	Moderate to High
Overall satisfaction in Perceived Usefulness	3.8125	0.7803	3.5421	4.0829	High
2. Perceived ease of use					

Construct	Statistics				Opinion Level
	Mean	S.D.	Confidence Interval		
			Lower	Upper	
2.1 The system can be easily accessed.	3.9063	0.8930	3.5969	4.2156	High to Highest
2.2 The process of using the program is straightforward and easy to comprehend.	3.9375	0.8776	3.6334	4.2416	High to Highest
2.3 The program interface is well-suited for utilization.	3.7500	0.9158	3.4327	4.0673	High
2.4 The system demonstrates rapid processing speed.	3.5625	0.8400	3.2714	3.8536	Moderate to High
2.5 The system is suitable for use.	3.4688	0.9153	3.1516	3.7859	Moderate to High
Overall satisfaction in Perceived ease of use	3.6563	0.8654	3.3564	3.9561	Moderate to High
3. Attitude towards use					
3.1 The system facilitates meeting the requirements of health claim assessors.	3.7500	1.1072	3.3664	4.1336	Moderate to High
3.2 The system serves as the preferred tool for utilization in the health claim approval process.	3.8438	0.9541	3.5132	4.1743	High
3.3 You are interested in utilizing the system to aid in the health claim approval process.	3.9063	1.0583	3.5396	4.2729	High to Highest

The mean scores for both perceived ease of use and perceived usefulness exceed 3.5, implying that health claim assessors generally hold positive perceptions of the new claim review system. These results indicate that the reviewers perceive the system to be relatively user-friendly and beneficial for their tasks.

The confidence intervals cover the mean scores for both constructs, indicating a reasonable level of confidence that the true population means lie within these intervals. Overall, the findings suggest that the system has been moderately well-received by health claim assessors.

In terms of perceived usefulness, users generally expressed high satisfaction with the benefits derived from the system's utilization. The aspect that received the highest rating was the system's ability to reduce the time spent in the process of reviewing and approving healthcare expenses, followed by its capacity to decrease the workload of health claim assessors. These aspects garnered high to highest levels of acceptance.

Regarding perceived ease of use, users overall were moderately to highly satisfied with the system's ease of use and appropriateness. The aspect that received the highest rating was the ease of understanding the program's functionality, followed by the system's convenience of access. These aspects received high to highest levels of acceptance. In terms of attitude towards use, users expressed the highest interest in utilizing the system to aid in the process of reviewing and approving healthcare expenses. Their acceptance of the technology was rated as high to highest.

The findings indicate that health claim assessors generally perceive the claim review system to be useful, easy to use, and favorable. These positive perceptions suggest that the system has the potential to be well-accepted and utilized by claim assessors in insurance companies.

5. Discussion

This study investigated the acceptance of a new claim review system among healthcare claim reviewers in insurance companies. The findings, based on data collected from 32 participants, provide valuable insights into the potential for successful system adoption within this user group.

The study revealed that healthcare claim reviewers generally held moderately positive perceptions of the new claim review system's ease of use (Overall: 3.66) and usefulness (Overall: 3.81), indicating a level of user acceptance but also room for improvement. In contrast, Wang et al. (2019) found higher mean scores for both perceived ease of use and perceived usefulness in their study on a mobile health insurance application in Indonesia, suggesting potentially greater user satisfaction. Differences between the studies may be attributed to factors such as technology type, target population demographics, and system complexity. While the current study focused on claim reviewers with likely varying technical familiarity, Wang et al. (2019) targeted users who might be more accustomed to mobile interfaces. Additionally, Hong et al. (2020) investigated digital healthcare acceptance among older adults, incorporating an extended TAM model to account for factors like perceived enjoyment and anxiety related to technology use. Insights from these studies underscore the importance of tailoring technology design and support strategies to meet the specific needs and preferences of diverse user populations, whether they are healthcare professionals or older adults. Understanding user attitudes towards technology adoption, including perceptions of its impact on work efficiency, decision-making, and job security, is crucial for successful implementation and acceptance in healthcare settings.

6. Conclusion

The study investigates the acceptance of a machine learning (ML) decision model within the health insurance system, focusing on healthcare claim reviewers' perceptions. It examines how perceived usefulness and ease of use of the ML model influence attitudes and adoption of the technology. Findings from a Likert scale questionnaire reveal high overall satisfaction with perceived ease of use, moderate to high satisfaction with perceived usefulness, and strong interest in attitude towards use. These results suggest that an ML-based health claim consideration system could be a valuable tool to support claim adjusters. Additionally, the study contributes to bridging gaps in existing research by emphasizing the importance of tailoring technology design and support strategies to meet the specific needs and preferences of diverse user populations. Understanding user attitudes towards technology adoption is crucial for successful implementation and acceptance in healthcare settings.

Limitations and Future Research

This study has limitations. The sample size was relatively small, and the participants were drawn from a specific geographic region. Further research with larger and more geographically diverse samples is recommended. Additionally, the study focused on self-reported perceptions. Future research could incorporate objective measures of system usage to gain a more comprehensive understanding of adoption behavior.

Implications for Practice

Despite these limitations, the findings offer valuable insights for insurance companies seeking to implement the claim review system. The positive user perceptions suggest that the system has the potential to improve claim processing efficiency and accuracy. To maximize the likelihood of successful adoption, insurance companies should provide adequate training and support to ensure claim reviewers are comfortable using the system and can leverage its full capabilities, continuously gather feedback from claim reviewers to identify areas for improvement and enhance the system's usability and effectiveness, effectively communicate the benefits of the system to claim reviewers, emphasizing its potential to streamline their work processes and improve customer satisfaction. By addressing these considerations, insurance companies can create an environment that fosters user acceptance and facilitates the successful integration of the claim review system into their operations.

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