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The Impact of Smart Home Technology on Insurance Claims: Insights for Information Systems

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Abstract

This study examines the impact of smart home security systems on property insurance claims. By analyzing insurance contract and claim case records from an insurance company, the research aims to identify correlations between the adoption of these technologies and the frequency and extent of burglary and property damage claims. Expert interviews highlight practical implications and strategies for integrating SHS into insurance products. The findings could influence insurance industry practices and the integration of these systems to enhance home security.

Keywords: Smart Home Systems; Security; Insurance Claims; Burglary; Fire; Water Damage.

1. Introduction

The integration of smart home technology within the insurance industry represents a significant development in the field of Information Systems (IS). The increasing adoption of smart home devices, such as burglar alarms, fire

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alarms, and water leak detectors, promises enhanced safety and security for homeowners, potentially leading to reduced insurance claims. By analyzing data from an insurance company, this study aims to provide valuable insights into the effectiveness of home security systems and their implications for insurance practices. Previous research has shown mixed results regarding the effectiveness of these systems, highlighting the need for comprehensive data analysis to understand their true impact. Our research aimed to address the following questions: (1) *To what extent does the use of smart home security systems impact property insurance claims for burglary and property damage?* and (2) *How can insurance companies implement the findings to enhance their insurance product offerings?*

This paper is structured as follows: Section 2 provides a background on the impact of smart home systems (SHS) on insurance claims and identifying gaps in the current knowledge. Section 3 outlines the research approach used in this study, combining quantitative analysis of insurance claims with qualitative insights from expert interviews. Section 4 presents our findings, and Section 5 interprets these findings in the context of their implications for pricing and integrating SHS in the insurance industry. Finally, the paper concludes with practical recommendations and suggestions for future research.

2. Background

Smart home systems (SHS), which include a variety of interconnected devices and sensors, have evolved significantly since their introduction in the 1980s. These systems are designed to enhance the comfort, convenience, security, and energy efficiency of homes [1]. The development of these systems has been significantly influenced by the Internet of Things (IoT), enabling the connection and communication of various devices within a home. This interconnected environment allows for remote monitoring and control of security systems, heating, lighting, and other household functions, fundamentally changing the landscape of home management.

The core components relevant to this study are home security systems such as burglar alarms, fire alarms, and water leak detectors. The presence of these systems is hypothesized to correlate with a decrease in the frequency and severity of insurance claims related to property damage and theft. The insurance industry has been closely monitoring the advancements in smart home technology due to its potential impact on risk management and claim reduction.

The literature suggests a potential for SHS to reduce the frequency and severity of insurance claims. For instance, burglar alarms can deter potential intruders, fire alarms can ensure early detection and response to fires, and water leak detectors can prevent extensive water damage by alerting homeowners to leaks early. However, the actual impact of these systems on insurance claims has been subject to debate. Some studies, like those by Tseloni et al. [2] and Tilley et al. [3], indicate a positive effect of security systems on reducing burglaries, while others suggest that the benefits may vary depending on the type of system and its implementation. Fire alarms have shown to significantly decrease the severity of fire damage claims by facilitating faster response times [4,5]. Similarly, water leak detection systems are highly effective in preventing major water damage, though their adoption rates remain relatively low [6,7].

Research by Davis [8] highlighted that while participants expressed a strong willingness to purchase home security devices if they were offered discounts on their insurance premiums, these systems were the least represented in their homes. This indicates a gap between the perceived value of smart home security systems and their actual adoption. Additionally to those, research by Eggert [9] highlights factors like perceived ease of use, usefulness, and data privacy concerns as influential in the adoption of smart home-based insurances. This emphasizes the need for insurance companies to ensure that their use of data from smart home devices complies with regulations, and to provide more compelling incentives to promote the adoption of these technologies.

The relationship between smart home systems and insurance claims is multifaceted. Insurance companies are interested in understanding how these technologies can influence their risk profiles and pricing models. In Norway, for example, several insurance companies offer discounts on premiums for homes equipped with security systems. However, *if insurance*[†], which does not currently offer such initiatives, could benefit from insights into the

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[†] https://www.if.no/en/

effectiveness of these systems. Understanding the specific impacts on claim frequency and severity can help insurers develop more accurate pricing models and encourage the adoption of smart home technologies.

3. Methodology

Our research was structured as a case study [10], focusing on data from the *if insurance* company. The choice of *if insurance* was based on the availability of comprehensive claims data; however, this limitation may affect the generalizability of our findings. The primary unit of study was residential properties insured by *if*, and the unit of analysis included the insurance claims related to these properties, categorized by the presence or absence of smart home systems.

We employed a mixed-method approach to explore the impact of smart home security systems on insurance claims. The research design includes both quantitative data analysis and qualitative insights obtained from expert interviews. This combination allows for a comprehensive understanding of the phenomenon, providing both statistical evidence and contextual interpretation. A sequential approach is utilized, enabling the integration of numerical data with expert opinions, enhancing the validity and depth of the findings.

3.1. Data Collection

Quantitative data were sourced from *if insurance* company's databases, including claims data and policy data from 2016 to 2018. The claims data contained information on the type of claim (burglary, fire, water damage), the presence of smart home systems, and the associated costs. Policy data provided details on the total number of insured contracts, including those properties with and without SHS. The datasets were cleaned and adjusted to ensure consistency and relevance for the analysis. Data cleaning involved the removal of duplicate claims and normalization of contract information across different SHS types.

Qualitative data was collected through semi-structured interviews with experts from *if insurance* company with extensive experience in property insurance and strategic partnerships. The interviews gathered insights on the practical implications of SHS, the challenges faced by insurance companies in integrating these technologies, and potential strategies for incentivizing their adoption. The interviews were recorded, transcribed, and analyzed to identify common themes and insights that complement the quantitative findings.

3.2. Data Analysis

The quantitative analysis involved statistical techniques to examine the correlation between the presence of SHS and the frequency and severity of insurance claims. The primary focus was on comparing claims data for properties with and without SHS. Key metrics included the number of claims, average payout per claim, and total claim costs. Claim frequency was computed as the number of claims divided by the number of contracts in a given period, while claim severity was measured by the total payout divided by the number of claims in the period. Chi-square tests were used to test the statistical significance of the observed differences. The analysis aimed to quantify the potential benefits of SHS in reducing insurance claims and to provide evidence for the development of insurance incentives.

The qualitative analysis involved coding and categorizing the interview transcripts to identify key themes. This process was guided by the research questions and aimed to enrich the quantitative findings with contextual understanding. Themes such as the perceived benefits, barriers to adoption, and strategies for integrating the technologies into insurance products were explored. The qualitative insights helped to interpret the quantitative results and provided practical recommendations for insurance companies.

3.3. Threats to Validity and Limitations

The data from the insurance company, including claim cases and contracts, was handled in accordance with data protection regulations to ensure privacy and security. We did not process any data not required to answer our research questions, such as the identity of policyholders or the geographic location of properties. Additionally, all participants

in the interviews were informed about the purpose of the research, and their consent was obtained before proceeding. The confidentiality and anonymity of the participants were ensured throughout the study.

Our research is limited to one insurance company and a relatively short period (2016-2018), which may affect the generalizability of the findings. Additionally, the analysis was restricted to the available data on SHS and insurance claims, which may not capture all potential variables influencing the results. Consequently, our findings may not fully represent the broader insurance industry, and further studies are recommended to validate and expand upon our results.

4. Findings

Before diving into the analysis of each claim category and the impact that smart home security systems have on insurance claims, Table 1 presents our population, i.e., the number of insurance contracts per year during the period 2016-2018. We specifically targeted contracts that provide compensation for burglary, fire, and water damage. The table also shows the frequency of SHS in relation to the total number of insurance contracts. As *if insurance* does not hold information about the coverage of water leak detectors, we created estimates based on Davis [8], suggesting that 7% of households have such a SHS.

Table 1. Overview of insurance contracts and coverage of burglar alarm, fire alarm, and water leak detector.

Year	Burglar insurance		Fire insurance		Water damage insurance	
	Contracts	With burglar alarm	Contracts	With fire alarm	Contracts	With water leak detector (estimated)
2016	117 500	43 090 (37%)	224 811	70 550 (31%)	224 811	15 737 (7%)
2017	120 402	44 596 (37%)	232 411	74 023 (32%)	232 411	16 269 (7%)
2018	128 214	43 071 (34%)	243 410	71 025 (29%)	243 410	17 039 (7%)
Average	122 039	43 436 (36%)	233 544	71 866 (31%)	233 544	16 348 (7%)

Table 2 presents an overview of the dataset on total claim and incurred costs. Water damage is the leading cause of both claim cost and claim frequency. Fire claims, while less frequent, incur high costs per incident, suggesting that each claim case is bigger in payout. In contrast, burglary claims constitute a smaller portion of the total payout but a considerable number of cases relatively to payouts, meaning each claim case is rather small in expense.

Table 2. Overview of claim payouts (in Norwegian Kroner) and claim cases related to burglary, fire, and water damage.

Year	Burglary		Fire		Water damage	
	Cases	Payout	Cases	Payout	Cases	Payout
2016	1719	Kr 26 498 082	2825	Kr 343 387 372	10955	Kr 491 604 521
2017	1378	Kr 20 503 768	2600	Kr 300 386 350	11000	Kr 426 148 678
2018	1562	Kr 20 126 468	2920	Kr 345 517 593	12667	Kr 529 740 985
Average	1553	Kr 22 376 106	2781	Kr 329 763 772	11541	Kr 482 498 061

4.1. Burglary Claims

The analysis of burglary claims revealed significant differences in the frequency and severity of claims between properties with and without burglar alarms, as illustrated in Table 3. Adjusting for the population, we found that although there are more claim cases for houses without alarms, the likelihood of a claim occurring in a house with an alarm is higher (1.68% > 1.04%) when considering an even population distribution. The data also indicates that houses equipped with burglar alarms had a 20% lower average payout per claim (Kr 13,025) compared to those without alarms (Kr 15,617), suggesting that burglar alarms effectively reduce the financial impact of burglary incidents. This indicates that while alarms may not entirely prevent burglaries, they seem to mitigate the loss incurred.

Table 3. Frequency and severity of burglary claims during the period 2016-2018.

Averages per year	With Burglary Alarm	Without Burglary Alarm	Total
Claim cases	732	821	1 553
Insurance contracts	43 436	78 603	122 039
Frequency (claims/contracts)	**1.68%**	**1.04%**	**1.27%**
Claim payout	Kr 9 513 418	Kr 12 862 688	Kr 22 376 106
Claim cases	732	821	1 553
Severity (payout/claim)‡	**Kr 13 025**	**Kr 15 617**	**Kr 14 393**

The Chi-squared test was conducted to determine if there is a significant association between the presence of burglar alarms and the occurrence of burglary claims. The observed data included the number of claims cases for properties with and without burglar alarms. The test yielded a Chi-squared value of $X^2 = 91.41$ with 1 degree of freedom and significance level of 0.05. Therefore, we reject the null hypothesis and conclude that there is a statistically significant association between the variables. Additionally, we computed an effect size of 0.027, indicating a small but notable association between having a burglar alarm and the reduction in claim frequency.

4.2. Fire Claims

As with burglary claims, we found out that the number of claim cases adjusted for the population is higher for properties with fire alarm (1.38% > 1.11%), as shown in Table 4. The impact of fire alarms on the severity of insurance claims was even more pronounced. Properties with fire alarms connected to a central system had significantly lower payouts per claim (Kr 79,715) compared to those without such alarms (Kr 139,839), highlighting the effectiveness of fire alarms in minimizing damage.

Table 4. Frequency and severity of fire claims during the period 2016-2018.

Averages per year	With Fire Alarm	Without Fire Alarm	Total
Claim cases	990	1791	2 781
Insurance contracts	71 866	161 678	233 544
Frequency (claims/contracts)	**1.38%**	**1.11%**	**1.19%**
Claim payout	Kr 78 944 148	Kr 250 819 624	Kr 329 763 772
Claim casesn m/.,	990	1791	2 781
Severity (payout/claim)‡	**Kr 79 715**	**Kr 139 839**	**Kr 118 471**

Like burglar alarms, we used Chi-squared test to determine if there is a significant association between the presence of fire alarms and the occurrence of fire claims. The test yielded a Chi-squared value of $X^2 = 30.78$ with 1 degree of freedom and a p-value below the significance level of 0.05. We conclude that there is a statistically significant association between having a fire alarm and the reduction in fire claim frequency, but with a small effect size of 0.011.

4.3. Water Leak Detection

According to Davis [8], around 96% of the water damage claim cases could be prevented and the severity of those cases were reduced by 72% by smart water leak detection. Using those values as estimates, we noted that the frequency of water damage claims in *if* dataset would lower for properties with water leak detectors (1.04%) compared to those

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‡ The severity here is not simply a division of claim payout by claim cases, but rather an average of the annual severities calculated for the years 2016, 2017, and 2018.

without (1.69%), as shown in Table 5. Additionally, the average payout for a claim with a water leak detector is almost four times smaller than for a claim without one.

Table 5. Frequency and severity of water damage claims during the period 2016-2018.

Averages per year	With Water Leak Detector	Without Water Leak Detector	Total
Claim cases (estimated)	170	3 677	3 847
Insurance contracts	16 348	217 196	233 544
Frequency (claims/contracts)	**1.04%**	**1.69%**	**1.65%**
Claim payout (estimates)	Kr 1 993 452	Kr 158 840 585	Kr 160 832 687
Claim cases (estimates)	170	3 677	3 847
Severity (payout/claim)‡	**Kr 11 706**	**Kr 43 202**	**Kr 41 810**

The Chi-squared test yielded a value of $X^2 = 40.02$ with 1 degree of freedom, resulting in a p-value below the significance level of 0.05. Therefore, we conclude that there is a statistically significant association between the presence of water leak detectors and the frequency of water damage claims. Additionally, an effect size of 0.013 indicates a small but meaningful association.

4.4. Expert Insights

Qualitative insights from two expert interviews supported the quantitative findings. Experts highlighted the importance of SHS in enhancing property security and mitigating risks. They also discussed the challenges in promoting the adoption of these technologies, including the costs of installation and concerns about data privacy. During the interviews, we addressed four questions:

1. *How an insurance company can collaborate with an alarm company and why doesn't If have any initiatives towards smart security systems?* Both experts suggested that insurance companies can benefit through partnerships offering discounts on smart home security systems to policyholders. Expert A emphasized that this could incentivize customers to adopt the technology, thereby reducing claims. Expert B added that joint marketing campaigns and bundled service offerings could enhance customer acquisition and retention for both parties. The absence of initiatives at *if insurance* might be due to a lack of evidence on the effectiveness of those systems (noted by Expert A), other strategic priorities, or resource constraints (Expert B).

2. *How can it be priced into insurance?* The experts agreed that smart home security systems can be priced into insurance through premium discounts for homes equipped with these systems. Expert A suggested analyzing the reduction in claim frequency and severity to offer lower premiums and incentivize adoption. Expert B proposed a tiered discount system based on the level of security provided by different SHS, where more comprehensive setups receive higher discounts. Both experts highlighted the importance of data analysis to determine appropriate discount levels.

3. *Any new technology that could be interesting?* Expert A highlighted integrating advanced IoT devices and AI-powered analytics into SHS, such as predictive maintenance sensors and AI-driven risk assessments. Expert B mentioned the growing interest in smart water shutoff systems and enhanced fire detection sensors that use machine learning to predict and prevent incidents. Both experts agreed that these innovations could significantly enhance the effectiveness of smart home security systems and impact insurance risk models.

4. *Discussion about the dataset?* Expert A noted that while the dataset provides valuable insights, it would benefit from a larger sample size and longer time span to strengthen the conclusions. Expert B recommended incorporating more variables, such as customer demographics and detailed device usage data, to improve the analysis. Both experts suggested conducting cross-industry comparisons to validate the results. Finally, expert B highlighted collecting real-time data from smart devices for more dynamic insights into their impact on claims.

5. Discussion

The findings from this study provide important insights into the impact of SHS on insurance claims, highlighting benefits associated with their adoption. This section explores a hypothetical scenario based on the study's results and discusses insights in the context of pricing practices and implications for the insurance industry.

5.1. To what extent does the use of smart home security systems impact property insurance claims for burglary and property damage?

Building on the findings, we explore a hypothetical scenario where all customers without alarms adopt them. This projection allows us to estimate the impact on claims and insurance pricing. Based on a yearly house insurance premium of Kr 6915 (average price for a house insurance in the period 2016-2018 [11]), we calculated potential pricing adjustments to determine effective initiatives for insurance companies.

If all customers adopted burglar alarms, based on the data from the results section, the impact on claims would be notable. Currently, there are 821 burglary claim cases without such alarms. With a 20% lower payout per claim, this would save Kr 2,128,032. However, with 505 additional claims expected due to increased frequency among properties with alarms, this would add Kr 6,577,625 in costs to the insurance company. These hypothetical calculations show that, the net effect is an additional cost of Kr 4,449,593. Dividing this by the current 122.039 existing insurance contracts, each of them would incur an extra Kr 36.46 (or +0.53% of the premium) to break even on profit.

Experts suggest focusing on fire and water damage prevention for the most value. Similar hypothetical projections were done for fire and water claims, based on 122.039 existing insurance contracts. For fire claims, while increased frequency would raise overall costs, the financial impact per claim might reduce by 75.4%, resulting in net savings of Kr 73,006,059. Based on the study's findings, universal adoption of smart fire alarms would allow for a discount of Kr 312.60 per contract, or 4.52% of the premium, to break even on profit. Adopting smart water leak detectors universally suggests a dramatic reduction in water damage claims, preventing up to 96% of claims and reducing severity by 72%, resulting to projected net savings of Kr 142,933,596. This would allow for a discount of 8.85% of the premium, or Kr 612 per contract, making this a valuable initiative for cost savings.

5.2. How can insurance companies implement the findings to enhance their insurance product offerings?

The hypothetical projections suggests that insurance companies, like *if*, could offer discount initiatives to policyholders who adopt smart home security systems, particularly fire alarms and water leak detectors. These pricing strategies could include fixed or variable discounts or integrating these SHS into their insurance products. These hypothetical scenarios highlight potential cost reductions and provide a basis for developing new insurance models.

The choice of strategy depends on the company's market position and goals. Small companies aiming to expand might benefit from cooperating with security companies to increase SHS distribution, despite potentially lower initial profits due to discounts. Medium-sized companies could adopt a variable discount strategy, adjusting discounts based on the profitability impact of SHS on their portfolio. Large companies might explore launching their own security companies to provide tailored products and maximize claim reduction benefits.

Implementing SHS represents a significant technological advancement for the insurance industry. This requires substantial investment in IT infrastructure and data analytics capabilities, and partnerships with technology providers can facilitate integration. Organizationally, insurance companies need to adapt their structures and processes to support SHS, including training staff to use data from smart home devices, updating policies to incorporate these new data sources, and fostering a culture of innovation. Effective change management strategies are crucial, involving clear communication of the benefits and requirements of SHS to employees and customers.

Socially, the adoption of SHS raises important considerations related to customer trust and accessibility. Insurance companies need to ensure transparency and robust data protection measures to address customers' privacy concerns. Additionally, support programs should be implemented to make these technologies more accessible to customers who may face financial or technological barriers. By addressing these factors, insurance companies can promote SHS adoption, leading to reduced claims, increased customer satisfaction, and an enhanced overall value proposition.

6. Conclusion

This study concludes that smart home security systems have a potential to impact the insurance industry by affecting the frequency and severity of claims. By analyzing data from *if insurance* company and projecting outcomes in a hypothetical scenario, we estimate that burglar alarms reduce average claim payouts by 20%, but implementing discounts would be counterproductive due to increased claim frequency. Fire alarms reduce average payouts and slightly increase claim frequency, making them suitable for variable discount strategies based on specific data. Water leak detectors offer the highest value by significantly reducing both claim payouts and claim frequency, making them essential for insurance companies to provide to their customers.

Insurance companies should consider these findings to enhance their products offers and customer satisfaction. Forming partnerships with SHS providers could enable insurers to offer bundled solutions, which would encourage customer adoption of such systems and potentially reduce claims-related costs. Alternatively, insurance companies could use internal data to set discounts based on variables affecting claim cases or offer a flat or variable discount.

Future research should include multiple companies to enhance the generalizability of the findings. It should also investigate the impact of other SHS technologies, such as smart thermostats or AI-powered devices, to gain a deeper understanding of their long-term effects. Furthermore, cross-industry comparisons would provide valuable insights into how different sectors respond to SHS adoption.

Acknowledgements

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