

# Impact of Financial Behaviour on Life Insurance Using Radial Basis Function Modelling

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## Abstract

A literature survey showed very few papers on the financial behaviour of Saudi Arabian people and its impact on their acquisition or maintenance of life insurance products. The reasons might be their attitudes, counter-intuitive behaviour, and social and religious factors. Their positive attitude and financial behaviour on Islamic insurance products like the Takaful may demonstrate this. This paper aims to examine the impact of the financial behaviour of Saudi customers on life insurance. A survey of 150 Saudi customers of a bank in Riyadh was used to analyse the response frequencies and identify predictive variables using the Radial Basis Function modelling approach. The results showed that the majority of trends in financial behaviour were comparison shopping, timely paying all bills, spending within budget or plan, paying off their credit card balances and maxing out the limits of their credit card/s, saving from every paycheck, saving for emergencies and long-term needs and contributing to retirement accounts. Most participants maintained or purchased adequate health insurance, property insurance and life insurance. However, the Radial Basis Function analysis did not lead to any prediction variable for Saudi citizens' insurance product purchase intentions, indicating other factors might be at play. The limited literature available and reviewed above did not deal with the aspects studied in this research. They mostly dealt with factors influencing decision-making by Takaful insurance customers. The generally positive trends in awareness about various insurance products and knowledge about their utility generally support the trends of this research findings.

**Keywords:** Financial Behaviour, Insurance Products, Life Insurance, Takaful, Saudi Arabia.

## Introduction

In a McKinsey report, Becker, Dreller, Güntner, and Lorenz (2020) highlighted the problem of people's counter-intuitive behaviour. This behaviour involves not doing what we know to be good for us. They cited some examples of nudging (subtle interventions to make better choices in purchases) methods to change the negative insurance behaviour of customers. They included customer conversations and innovative product design changes. Easily understood language can increase the acceptance of insurance products. Extending cool-off periods can prevent customers from cancelling contracts impulsively. Use of call centres and increasing customer contacts with

demographically similar insurance representatives promote sales. Asking customers to present a short video presentation of their losses in claims settlements and providing health insurance products as packages helps to improve claims. Linking with offerings from a broad range of partner products improves consumer-insurer interactive ecosystems.

In a systematic review, Bhatia, Bhat, and Tikoria (2021) examined behaviour-related antecedents, which are defined as the antecedents of consumer insurance purchase behaviour patterns. Consumers save money or assets as a precaution, bequest, wealth accumulation and lifecycle purposes. These trends can be related to their insurance behaviour. Consumers prefer insurance products as a precaution against post-retirement life, to take care of their death financially affecting dependents and to take care of children's education and marriage and other life purposes (Deb et al., 2021; Striani, 2023). The death of family members can motivate people to opt for life insurance. Word of mouth is another influencing factor. Bequest motives arise from being married and having many children. Consumers owning smart devices are more likely to purchase insurance products than those who do not. Life insurance products are more popular among those who hold a low survival probability after an age. Risk avoidance is another factor favouring the purchase of insurance products. Possession of valuable assets and household financial activities can motivate insurance product purchases. Certain religious beliefs, long-term saving attitudes, high emotional arousal to losses, long-term saving attitudes, subjective norms (Theory of reasoned action), self-protective attitudes towards their wealth, trust in future, need for financial safety, financial perceptions and behavioural biases are some factors influencing consumer behaviour on insurance products. (Mahdzan & Victorian, 2013).

Macro-environment sub-categories influencing consumer purchase decisions of insurance products include economy-related antecedents, regulation-related antecedents, culture-related antecedents, geography-related antecedents, population-related antecedents and government-related antecedents. Two theories related to consumer behaviour on the purchase of insurance products are the normative theory, which explains that consumers use logical and analytical systems to evaluate purchase decisions, and the bounded rationality theory, in which the consumers rely on their intuitions and gut feelings to evaluate the purchase decision. (Chakraborty & Das, 2022; Chakraborty & Das, 2023).

Thus, many factors affect consumer behaviour in purchase decisions on insurance products. This paper aims to evaluate financial behaviours affecting the life insurance purchase decisions of Saudi Arabian consumers.

## **Literature Review**

The insurance penetration rate in Malaysia is only about 60%, although it was introduced by the British in the 18th and 19<sup>th</sup> centuries. A survey of 350 working Malaysian adults by Guan, Yusuf, and Ghani (2020) showed that product, price, place, promotion and attitude influenced their purchase intention of insurance products. Out of these marketing mix factors, product was the most important influence on life insurance purchase decisions. Attitude mediated the relationship between marketing stimuli and purchase behaviour. Thus, the 4P marketing mix (product, price, place and promotion) influences customer attitude, leading to customer purchase intention. Black box theory was applied in this study. The authors used only the 4P marketing mix. This could be due to the black box theory of Kotler and Armstrong (2012), which was based on the 4P mix.

In the studies of Saleh, Abbasi, Falasi, Almheiri, and Echchabi (2022), only 56% of the participants were Takaful insurance customers. Uncertainty (negative), awareness, social influence and compatibility determined their intentions to purchase Takaful insurance.

Maduku and Mbeya (2024) integrated religious obligation into the theory of planned behaviour towards Takaful insurance by 225 South African Muslims. Purchase intention was supported by attitude, subjective norm and perceived behavioural control. Although religious obligation supported attitude, subjective norm and perceived behavioural control, it did not support either purchase intention or purchase behaviour. There were gender differences in these results.

From a survey of 230 consumers from Jakarta, Antony, Budi, and Sudaryanto (2023) observed that insurance awareness, perceived value, and the COVID-19 pandemic significantly influenced customer retention. Insurance agents, psychological factors and financial literacy significantly influenced insurance awareness. E-service quality significantly affected perceived value. The interaction between the COVID-19 pandemic and insurance awareness and between the COVID-19 pandemic and perceived value did not affect customer retention.

Maurya, Bansal, Ansari, and Mishra (2023) surveyed 228 Indian participants who lacked health insurance coverage. The study aimed to identify key factors influencing the health insurance purchase intentions of middle-class consumers, considering behaviour changes induced by COVID-19. The structural model accounted for two-thirds of the variation in attitudes and intentions to purchase health insurance. Factors affecting the intention to buy health insurance included attitude, customer trust, herd behaviour, decision delegation preference, and subjective norms. Perceived usefulness, involvement in the purchase decision, and awareness of health insurance predicted attitudes towards purchasing health insurance. The strongest predictor of purchase intention was attitude, followed by customer trust, decision delegation preference, and herd behaviour, in that order. Attitude was best predicted by health insurance awareness, perceived usefulness, subjective norms, involvement in the purchase decision, and perceived risk, in decreasing order. Additionally, health insurance awareness moderated the relationship between perceived risk and attitude towards health insurance purchase.

Riaz, Saleem, and Aqdas (2021) surveyed 206 Pakistani Takaful insurance customers from three cities. The study showed that adherence to the Islamic religion, the reputation of Takaful, and product awareness were related to the demand for the family Takaful. Marketing or advertising did not influence this demand.

Using an online survey of 362 Saudi family Takaful insurance policyholders, Osman, Rehman, Ul Din, Shams, and Aziz (2022) showed that the corporate image of the Takaful providers was impacted only by the reliability and assurance dimensions of service quality and Islamic ethical behaviour and structural bonds aspects of relationship marketing. Corporate reputation mediated the relationship between corporate image and customer loyalty.

To determine various factors responsible for the decision-making while purchasing health insurance by the people, Parihar and Ghosh (2021) surveyed 240 Gwalior people. The results showed that six factors determined the participants' buying decision-making behaviour regarding health insurance. The factors were awareness, company-related information, risk, promotion and tax benefits and security.

The responses of 377 Pakistani salaried persons from a survey by Aziz, Afaq, Muhammad, and Khan (2020) showed word of mouth and media referent were the determinants of subjective norms. Subjective norms were related to attitude and intention to purchase family Takaful schemes. Attitude towards family Takaful determined its purchase.

Data were collected from 200 Takaful policyholders and 200 conventional insurance policyholders in Pakistan. The results showed that religiosity plays a significant role in shaping the insurance preferences of individuals in a Muslim-majority country. Understanding which dimension of religiosity impacts insurance choices is useful for designing more advanced insurance products tailored to align with the target market requirements. In this research, only Islamic knowledge and avoiding haram dimensions of religiosity influenced their insurance preferences (Riaz, Akram, & Saad, 2023).

A search for papers showed very few papers related to this research topic. Most of them were not directly related to the survey items of this study.

## **Methodology**

This study investigates the impact of financial behaviours on life insurance purchase decisions using a Radial Basis Function (RBF) neural network model. The research aims to identify how specific financial habits influence decisions about purchasing life insurance policies. The methodology used to collect data, and their analyses are outlined in the following subsections.

## **Participants**

A total of 150 participants from diverse demographic backgrounds in Saudi Arabia were surveyed. The demographic data collected included age, gender, education level, employment status, household income, marital status, and household size. The data collection was strategically conducted outside a major bank in Riyadh, providing direct access to a varied cross-section of the population engaged in financial activities. The data was collected in the month of October 2024.

## **Data Collection**

Data were gathered through a structured questionnaire based on the Financial Management Behaviour Scale (FMBS) developed by Dew and Xiao (2011), which assesses various aspects of financial behaviours. Participants rated their frequency of engaging in different financial activities over the past six months on a scale from 1 (Never) to 5 (Always). Additionally, insurance behaviours over the past year were rated on the same scale.

## **Variables**

The primary input variables included 12 financial behaviours like comparison shopping, timely bill payments, budgeting, and investment practices. The dependent variable was the maintenance or purchase of adequate life insurance.

## **Data Analysis**

The analysis involved:

- Preprocessing: Standardisation of the input variables to ensure comparability and improve the performance of the neural network.
- Modelling: Utilising a Radial Basis Function (RBF) neural network with a hidden layer composed of two units, determined to minimise error based on testing data.
- Validation: The data were split into training (71.3%) and testing (28.7%) subsets to validate the model's predictive capabilities.
- Evaluation Metrics: The model's performance was assessed based on the Sum of Squares Error and the percentage of incorrect predictions for both training and testing datasets.

- **Classification Metrics:** The model's accuracy in predicting insurance maintenance was evaluated through classification tables and the area under the curve (AUC) for each insurance behaviour category.

### Results Interpretation

The RBF model's outcomes, including high prediction error rates and low classification accuracy, highlighted challenges in predicting life insurance behaviours based solely on financial management practices. Recommendations include reconsidering model architecture or exploring alternative methods for improved predictive performance.

### Ethical Considerations

Participation in the study was voluntary, with assurances of anonymity and confidentiality. Informed consent was obtained from all participants, and ethical standards were upheld throughout the research process.

### Results

The results obtained using the above methods are outlined below.

### Demographics

The demographic variables of participants were measured, and the results are presented in Table 1.

Table 1. Demographics of the participants.

		Frequency	Per cent
Age	Under 18	21	14.0
	18-24	19	12.7
	25-34	21	14.0
	35-44	14	9.3
	45-54	17	11.3
	55-64	30	20.0
	65 or older	28	18.7
	Total	150	100.0
Gender	Female	45	30.0
	Male	67	44.7
	Prefer not to say	38	25.3
	Total	150	100.0
Education	Less than high school	26	17.3
	High school diploma or equivalent	35	23.3
	Post-school diploma	32	21.3
	Bachelor's degree	32	21.3
	Post-graduate or higher	25	16.7
	Total	150	100.0
Employment	Employed full-time	21	14.0
	Employed part-time	21	14.0
	Retired	18	12.0

		Frequency	Per cent
	Self-employed	26	17.3
	Student	18	12.0
	Unemployed	23	15.3
	Other	23	15.3
	Total	150	100.0
Income	Less than 50,000 SAR	22	14.7
	50,000-99,999 SAR	20	13.3
	100,000-149,999 SAR	21	14.0
	150,000-199,999 SAR 65	24	16.0
	200,000-299,999 SAR	22	14.7
	300,000 SAR or more 35	13	8.7
	Prefer not to say	28	18.7
	Total	150	100.0
Marital Status	Divorced	44	29.3
	Married	43	28.7
	Single	31	20.7
	Widowed	32	21.3
	Total	150	100.0
Household Size	1	32	21.3
	2	28	18.7
	3	29	19.3
	4	32	21.3
	5 or more	29	19.3
	Total	150	100.0

There were 21 (14%) under 18 participants. From the employment data, it appears that most of them (18, 12%) were students. Excluding them, 44 (36%) were under 45 years old, and the rest were over 45 years old. The largest group was those above 55 years old, comprising 58 (38.7%). Barring 38 (25.3%) not preferring to disclose their gender, male participants dominated with 67 (44.7%), and the remaining 45 (30%) were female participants. Out of 150 participants, 93 (61.9%) did not possess a university education. The rest had either a degree or a post-graduate qualification at or beyond the master's level. Excluding 28 (18.7%) who did not want to reveal their income, 22 (14.7%) were in the lower-income (<50K SAR) group, 65 (43.3%) were in the middle-income (50K to 300K) group, and the remaining 13 (8.7%) were in the high-income (8.7%) group. Divorced (44, 29.3%) were the highest group of participants, closely followed by 43 (28.7%) married participants; 32 (21.3%) were widowed, and the remaining 31 (20.7%) were single. While 32 each had one or four households, 29 each had 3 or 5, and 28 had two households.

### Financial Management Behaviour

In Table 2, the financial management behaviour of participants is presented. Table 2. Financial Management Behaviour of the survey participants.

Item		1 (Never)	2 (Seldom)	3 (Sometimes)	4 (Often)	5 (Always)
Comparison shopped when purchasing a product or service	n	32	27	27	25	39
	%	21.30%	18.00%	18.00%	16.70%	26.00%
Paid all your bills on time	n	32	20	40	32	26
	%	21.30%	13.30%	26.70%	21.30%	17.30%
Kept a written or electronic record of your monthly expenses	n	41	30	30	21	28
	%	27.30%	20.00%	20.00%	14.00%	18.70%
Stayed within your budget or spending plan	n	25	27	37	33	28
	%	16.70%	18.00%	24.70%	22.00%	18.70%
Paid off credit card balance in full each month	n	36	34	33	26	21
	%	24.00%	22.70%	22.00%	17.30%	14.00%
Maxed out the limit on one or more credit cards	n	27	27	32	28	36
	%	18.00%	18.00%	21.30%	18.70%	24.00%
Made only minimum payments on a loan	n	30	27	26	27	40
	%	20.00%	18.00%	17.30%	18.00%	26.70%
Began or maintained an emergency savings fund	n	26	21	35	40	28
	%	17.30%	14.00%	23.30%	26.70%	18.70%
Saved money from every paycheck	n	28	34	27	33	28
	%	18.70%	22.70%	18.00%	22.00%	18.70%
Saved for a long-term goal such as a car, education, home, etc.	n	20	41	25	35	29
	%	13.30%	27.30%	16.70%	23.30%	19.30%
Contributed money to a retirement account	n	22	28	42	29	29
	%	14.70%	18.70%	28.00%	19.30%	19.30%
Bought bonds, stocks, or mutual funds	n	30	44	26	19	31
	%	20.00%	29.30%	17.30%	12.70%	20.70%

Out of 150, 59 (39.3%) participants never or seldom did comparison shopping. The remaining 91 (60.7%) participants did comparison shopping sometimes, often or always.

All bills were never or seldom paid by 52 (34.6%) of the participants. The rest, 98 (65.4%), paid their bills sometimes, often or always.

All monthly expenses were manually or electronically recorded sometimes, often or always by 79 (52.7%) while such a record was not kept or seldom kept by the remaining 71 (47.3%) of the participants.

While 98 (65.4%) participants stayed sometimes, often or always within their budget or plan, the other 52 (34.6%) seldom or never could do it. It may not mean that they exceeded their income.

While 70 (44.7%) of the participants seldom or did not pay off their credit card balances within each month, the other 80 (55.3%) of the participants paid off their credit balances often, sometimes or fully each month. Out of 150, 54 (36%) never or seldom maxed out the limits of their credit card/s, and the remaining 96 (64%) maxed out the limits of their credit card/s sometimes, often or always. While 57 (38%) never or seldom made minimum payments on loans, the other 93 (62%) sometimes, often or always did it. The purpose of this question is not clear, as nobody will repay more than the loan to be paid.

Out of 150, 47 (31.3%) began or maintained an emergency savings fund, and the rest, 103 (68.7%) sometimes, often or always began or maintained a savings fund for emergencies.

There were 88 (58.7%) of the participants, who sometimes, often or always saved money out of every paycheck. On the other hand, 62 (41.3%) of the participants seldom or never saved money from every paycheck.

Saving for long-term needs was seldom, often or always done by 89 (59.3%), while it was seldom or never done by 61 (40.7%) of the participants.

While 50 (33.3%) never or seldom contributed to retirement accounts, the other 100 (66.7%) sometimes, often or always did so.

Out of 150, 74 (49.3%) never or seldom bought bonds, stocks or mutual funds, and the remaining 76 (50.7%) sometimes, often or always bought one or more of these.

### Insurance

The response frequencies of the survey participants on their insurance behaviour are presented in Table 3.

Table 3. Response frequencies of the survey participants on their insurance behaviour.

Item		1 (Never)	2 (Seldom)	3 (Sometimes)	4 (Often)	5 (Always)
Maintained or purchased an adequate health insurance policy	n	30	41	22	36	21
	%	20.00%	27.30%	14.70%	24.00%	14.00%
Maintained or purchased adequate property insurance like auto or homeowner's insurance	n	34	29	26	33	28
	%	22.70%	19.30%	17.30%	22.00%	18.70%
Maintained or purchased adequate life insurance	n	30	35	33	30	22
	%	20.00%	23.30%	22.00%	20.00%	14.70%

Adequate health insurance policies were never or seldom maintained purchased by 71 (47.3%) of the participants. On the other hand, 79 (52.7%) of the participants maintained or purchased adequate health insurance policies sometimes, often or always.

Out of 150, 63 (42.3%) never or seldom maintained or purchased property insurance policies. The other 87 (57.7%) sometimes, often or always maintained or purchased property insurance policies.

Adequate life insurance policies were maintained or purchased by 85 (56.7%), while 65 (43.3%) never or seldom maintained or purchased adequate life insurance policies.

### Radial Basis Function Modelling Results

The results obtained from the Radial Basis Function modelling of the data are described below.

The sample was broken down into 71.3% for training and 28.7% for testing with all cases valid and none excluded.

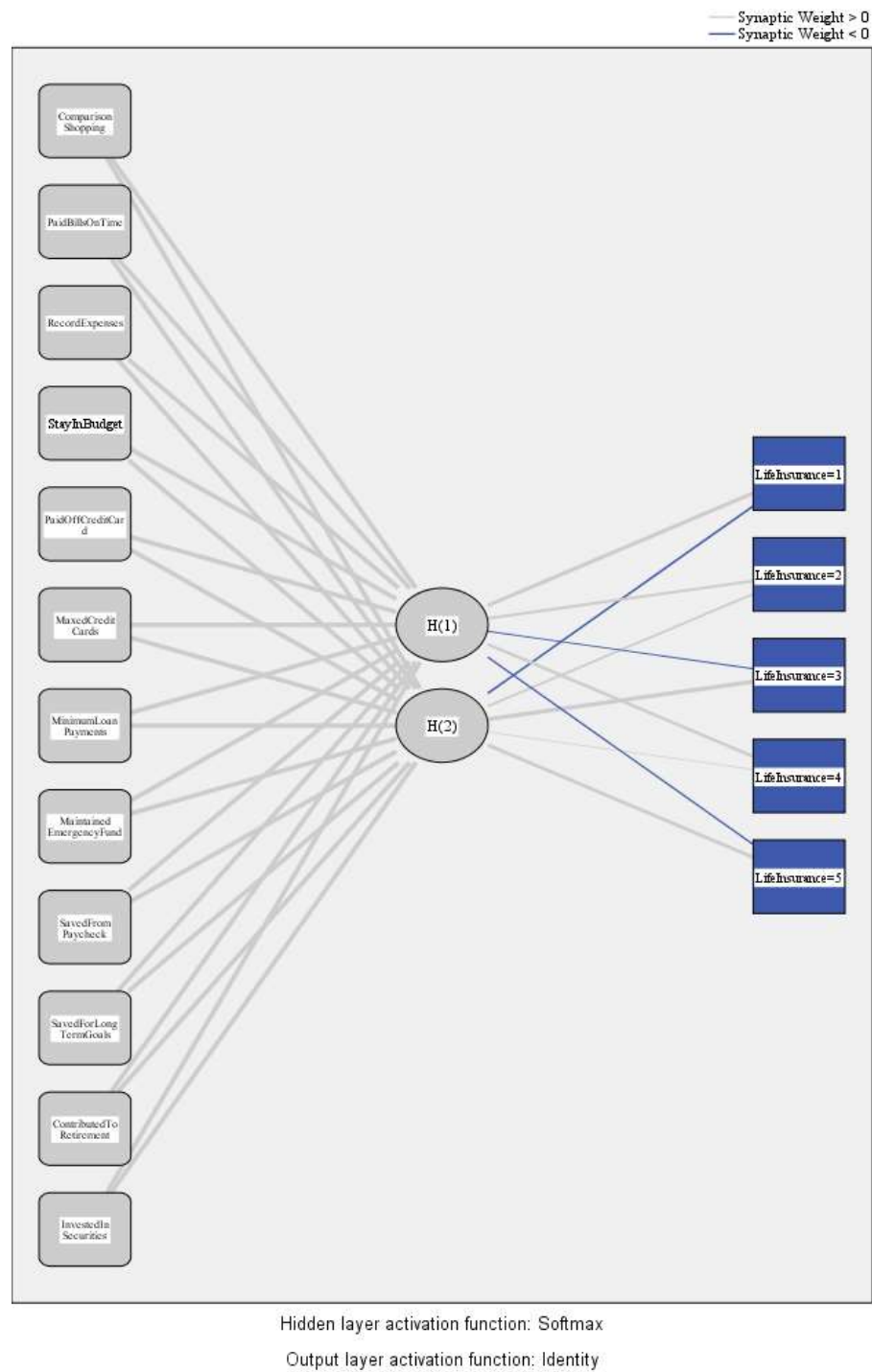
In the network, the input layer included 12 financial management behaviours using standardised rescaling.

The hidden layer contained two units determined by the testing data for minimal error. The activation function used was SoftMax.

The output layer was used to predict the likelihood of maintaining or purchasing life insurance with an identity activation function and a sum of squares error function.

Figure 1. RBF model (inputs, hidden layer and outputs)





The model summary is given in Table 4.

Table 4. Model Summary.

Training	The sum of Squares Error	42.170
	Per cent Incorrect Predictions	73.8%

	Training Time	0:00:00.11
Testing	The sum of Squares Error	17.074 <sup>a</sup>
	Per cent Incorrect Predictions	81.4%

Dependent Variable: Insurance - Maintained or purchased adequate life insurance

a. The number of hidden units is determined by the testing data criterion: The "best" number of hidden units is the one that yields the smallest error in the testing data.

The model showed a high error and incorrect prediction rates, indicating insufficient performance in predicting insurance behaviour.

The results of the classification are given in Table 5.

Table 5. Classification Results.

Sample	Observed	Predicted					Per cent Correct
		Never	Seldom	Sometimes	Often	Always	
Training	Never	11	0	7	4	0	50.0%
	Seldom	9	0	12	2	0	0.0%
	Sometimes	6	0	12	5	0	52.2%
	Often	8	0	10	5	0	21.7%
	Always	2	0	11	3	0	0.0%
	Overall Percent	33.6%	0.0%	48.6%	17.8%	0.0%	26.2%
Testing	Never	1	0	4	3	0	12.5%
	Seldom	4	0	6	2	0	0.0%
	Sometimes	3	0	5	2	0	50.0%
	Often	3	0	2	2	0	28.6%
	Always	1	0	5	0	0	0.0%
	Overall Percent	27.9%	0.0%	51.2%	20.9%	0.0%	18.6%

Dependent Variable: Insurance - Maintained or purchased adequate life insurance

Training Correct Predictions: Ranged from 0% to 52.2%, with only 26.2% overall accuracy.

Testing Correct Predictions: Also low, with an overall accuracy of 18.6%.

These low percentage values indicated the model struggled to accurately classify insurance purchasing behaviour.

Table 6. Area Under the Curve (AUC).

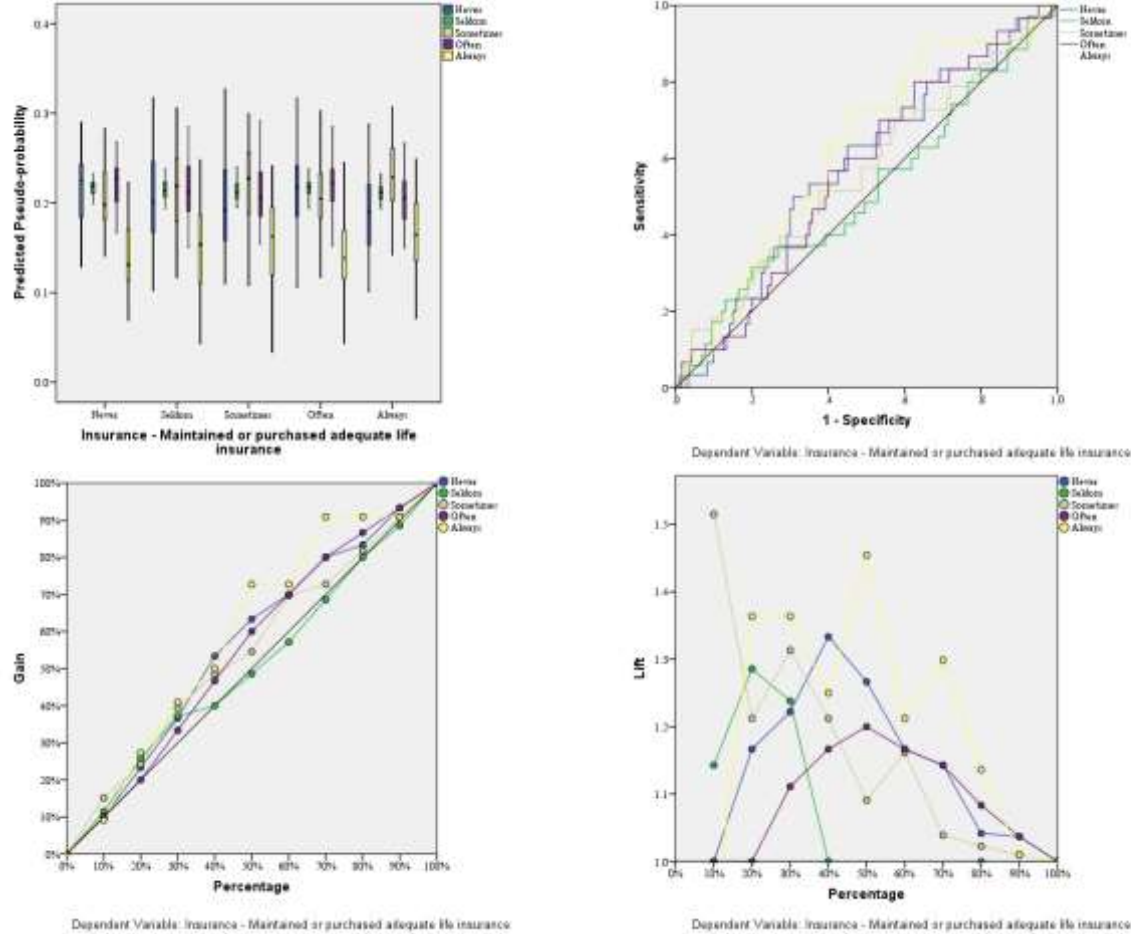
	Area
Insurance - Never	.575
Maintained or Seldom	.514

purchased	Sometimes	.559
adequate life	Often	.567
insurance	Always	.621

AUC values range from 0.514 to 0.621 across categories, reflecting poor to slightly better than random classification ability.

The figures related to network information, predicted pseudo-possibilities, sensitivity, gain and lift are shown in Figure 2.

Figure 2. Network information, predicted pseudo-possibilities, sensitivity, gain and lift.



## Discussion

This study aimed to investigate the impact of financial behaviour on life insurance uptake among Saudi consumers, using Radial Basis Function (RBF) modelling to analyse survey data from 150 participants in Riyadh. Our findings show generally positive trends in financial awareness and insurance engagement, yet the RBF model revealed no significant predictors of life insurance purchase intent based solely on financial management practices. These results illuminate the complexity of this market dynamic and resonate with themes from the existing literature.

Previous studies identified various factors influencing consumer insurance behaviour, including economic, cultural, and religious dimensions (Chakraborty & Das, 2022; Mahdzan & Victorian, 2013). Our findings align with research highlighting financial behaviours such as budgeting and

timely bill payment, which are prevalent among Saudi Arabian consumers. However, similar to Guan, Yusuf, and Ghani (2020), who identified marketing factors as central to life insurance decisions in Malaysia, our results suggest other latent variables beyond financial practices, might significantly drive purchase intentions. This aligns with the awareness raised by Saleh et al. (2022), where purchase intentions were influenced more by social and psychological factors rather than straightforward financial behaviours.

The prediction failure of the RBF model implies that financial management behaviour, in isolation, is insufficient to capture the complete spectrum of influences on life insurance acquisition. This accords with the insights from Osman et al. (2022), where qualitative aspects like service quality and corporate image were critical for customer loyalty towards Takaful products. Furthermore, Maurya et al. (2023) emphasised behavioural and attitudinal variables, which seem warranted given our study's outcomes.

Notably, religious and cultural considerations, which are crucial in the context of Saudi Arabia, were not explicitly investigated here. Previous works (Riaz, Saleem, & Aqdas, 2021; Riaz, Akram, & Saad, 2023) have shown Islamic principles and cultural nuances significantly sway insurance preferences. This suggests that integrating such dimensions with financial behaviour parameters may improve predictive models.

## Conclusion

This study's exploration into the financial behaviours affecting life insurance purchase decisions among Saudi consumers has yielded significant insights. While trends indicate a solid foundation in financial literacy and proactive fiscal habits, these alone do not robustly predict insurance uptake when analysed through RBF modelling. This underscores the importance of a multi-faceted approach that includes lifestyle, cultural, and psychological factors, which could provide a richer understanding of consumer motivations in this sector.

Our research's inability to uncover strong predictive variables calls for further studies incorporating broader determinants like religious beliefs and socio-cultural dynamics, paralleling the multidimensional models used in global studies (Parihar & Ghosh, 2021; Maduku & Mbeya, 2024). Additionally, future research might benefit from exploring the interactions of digital literacy and emerging technological platforms in shaping consumer decisions, especially given the rapid digitisation of financial services.

Ultimately, these findings encourage insurers and policymakers to consider more comprehensive, culturally tuned engagement strategies to better meet the needs of the Saudi insurance market, confirming the sentiments expressed in the literature. This integrated understanding can help design more effective communication and product offerings that resonate with diverse consumer bases, ensuring greater alignment with their values and expectations.

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