Decision Support System for Property Insurance Selection Using Simple Additive Weighting (SAW) Method

Anggraini Kusumaningum[a,1,] Astika Ayuningtyas[b,2], Leonardo P. Tampubolon[c,3], Anton Setiawan[d,4], Haruno Sajati [e,5], Mardiana Irawaty [f,6]

[a,b,c,d,e,f] Adisutjipto Institute of Aerospace Technology, Yogyakarta, Indonesia

[1] anggraini@itda.itda.ac.id , [2]astika@itda.ac.id *; [3] ltampubolon00@gmail.com, [4] anton_s_h@yahoo.com, [5]haruno@itda.ac.id , [6]mi0006@yahoo.com

Abstract

Every human cannot predict what incidents will happen to him, whether natural disasters or non-natural disasters, to his property assets. Property insurance is a type of protection for property assets such as houses, apartments, and offices. It aims to anticipate financial losses due to unexpected property loss incidents. Data such as Risk-Based Capital (RBC) is needed to select a property insurance company, the amount of premium, insurance coverage, and the premium period as a material consideration in making decisions. In implementing the Property Insurance Selection Decision Support System Application using the Simple Additive Weighting (SAW) method, the user determines the main priority weights from the predetermined criteria. In determining the priority weights, the property owner obtains a recommendation for companies' property insurance from the calculation results. It indicates that the average calculation speed of 30 experimental sample data applications is 1264 ms or 1.264s.

Keywords: *Decision Support System*, *Simple Additive Weighting (SAW), Property Insurance.*

I. INTRODUCTION

In life, every human cannot predict what incidents will happen to him, whether natural disasters or non-natural disasters that can occur to his property assets. Therefore, it is necessary to be able to protect their property against dangers that can harm them by insuring it with an insurance company.

According to the Commercial Code (KUHD) Article 246, insurance is an agreement whereby an insurer binds himself to the insured by receiving a premium to compensate him for a loss, damage, or loss of expected profit, which may occur due to an unspecified event. Property insurance or property insurance protects the property in the form of buildings, furniture, machinery, and so on from damage or loss, fire, theft, and earthquakes. In choosing an insurance company as the insured, you must pay close attention to criteria such as the company's brand image, premium size, ease of claim procedures, policies, and so on, as a consideration in making decisions [1].

The SAW method can also be used for the selection of prospective bidikmisi scholarship recipients [2], controlling the price of necessities [3], hotel selection recommendations [4], and Selection of Goods Transportation Company [5]. SAW can also be mixed with other methods to obtain optimal recommendations for a case. The use of the SAW and AHP methods for the selection of study programs [6], combining saw and wp methods for hiring new employees [7], and the use of the ANP method in determining the price of fire insurance premiums can make it easier to manage the calculation of fire premiums [8]. The selection of insurance products using the profile matching method compares individual competencies with job competencies [9].

II. RESEARCH METHOD

In implementing the Decision Support System Application for Property Insurance Selection with the Simple Additive Weighting (SAW) Method, the user determines the main priority weights from the predetermined criteria. From the results of determining the priority weights, a recommendation for property insurance companies is obtained, which is desired by the property owner. Therefore, the Decision Support System Application. Selecting Property Insurance with the Simple Additive Weighting (SAW) method helps property owners determine the appropriate company based on the property owner's priority criteria. The steps of the saw method are as follows:

1. Specifies the parameter attribute. Determines whether the parameter is a benefit or cost attribute type.
2. Determine The Reference Weight.
3. Making alternative suitability ratings and criteria
4. Normalize Matrix. Using the Formula (1)

$$r_{ij} = \begin{cases} \dfrac{x_{ij}}{\max(x_{ij})} \\ \dfrac{\min(x_{ij})}{x_{ij}} \end{cases} \dots\dots\dots\dots\dots\dots\dots(1)$$

Description :

r_{ij} = normalized performance rating of alternative Ai on attribute Cij; i=1,2,..,m and j= 1,2,..,n.

Xij = value of each attribute column
Max (xij) = maximum value of each attribute column
Min (xij) = minimum value of each attribute column

5. Ranking Process
If the normalization matrix and reference weights are known, then you can find the ranking value of each alternative. Using the formula (2)

$$v_j = \sum_{j=1}^{n} w_j r_{ij} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(2)$$

Description :
V_j = is the preference value of each alternative for j = 1,2,..,n
W_j = is the preference weight of the decision-maker
R_{ij} = normalized performance rating of alternative Ai on attribute Cij; i=1,2,..,m and j= 1,2,..,n

A. Data Needs Analysis

The data was obtained from the insurance company's website and interviews with the insurance company. Collected data were used to perform manual calculations to determine property insurance using the SAW method. The data can be seen in Table 1.

Table 1. Data of Company Criteria

No	Perusahaan	Risk-based capital	premium	Coverage	Premium Term
1	Asuransi Central Asia	374%	0,138%	13	1 Year
2	Asuransi Allianz Indonesia	282%	0,2194	13	1 Year
3	Chubb General Insurance	451%	0,07960%	15	1 Year
4	Asuransi Astra Buana	238%	0,05380%	12	1 Year
5	Bri Asuransi Indonesia	363%	1,5%	9	1 Year
6	Asuransi Wahana Tata	335%	0,08381%	14	1 Year
7	Asuransi Tugu Pratama	397%	0,12734%	10	1 Year
8	Asuransi Umum Bca	345%	0,75400%	7	1 Year
9	Asuransi Msig Indonesia	269%	0,1996%	14	1 Year
10	Asuransi Sinarmas	432%	1.60%	13	1 Year

B. System Design DFD level 0

There are 2 users in this vehicle insurance decision support system: admin as administrator and the community as ordinary users. Admin is in charge of entering vehicle insurance company data in the form of company name, Risk-based capital, premium, and premium terms. In addition to insurance company data, the admin inputs the criteria needed to determine each insurance company's recommendations and coverage data.

Meanwhile, normal users only need to input the percentage weight of each predetermined criterion, such as Risk-based capital, premium, coverage, and premium term. Figure 1 is a level 0 DFD of the system.
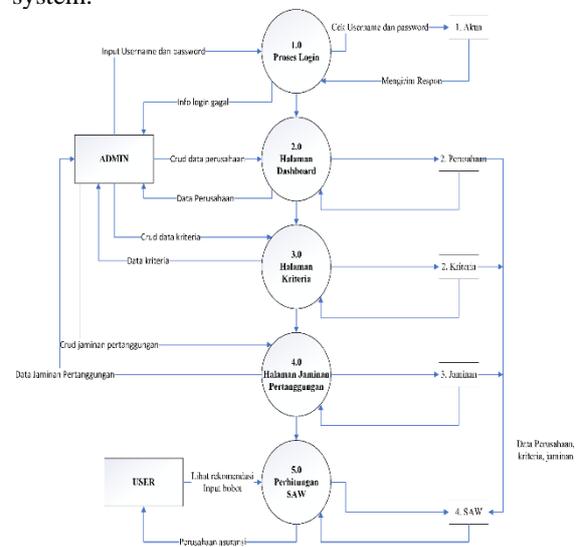

Figure 1. DFD Level 0

III. RESEARCH RESULTS

A. Admin Implementation Application

After successful login, the admin will be redirected to the dashboard page. On the admin dashboard page, you can view company data, add, edit, and delete company data. Figure 2 is the implementation dashboard and company data.
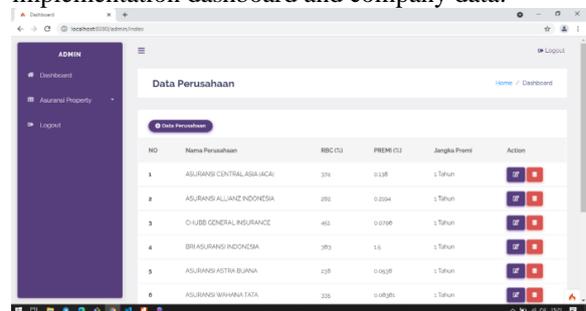

Figure 2. Data Company Page

To enter the criteria page, the admin needs to move to the criteria page contained in the property insurance sidebar submenu. A criteria page is a page that contains criteria data, weights, and criteria descriptions. Figure 3 is the criteria page.
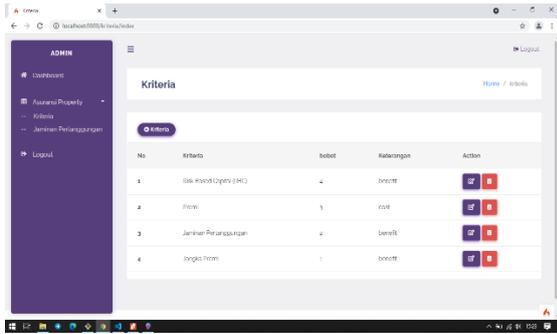
Figure 3. Criteria Data Page

To enter the insurance coverage page, the admin needs to move to the Insurance coverage page on the property insurance sidebar submenu. The insurance coverage page is a page that contains data on the company name and insurance coverage. Figure 4 is the cover page.
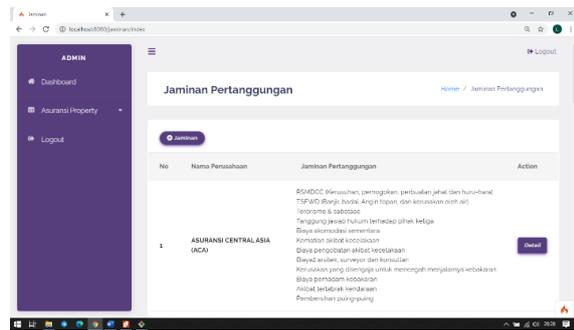

Figure 4. Coverage Data Page

B. User Implementation Application

The user's main page displays the criteria weight input form, which is the reference for selecting property insurance. Figure 5 is the user dashboard page.
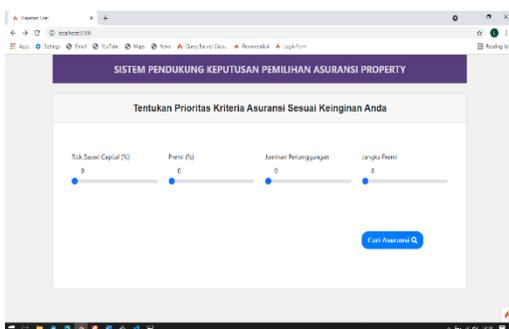

Figure 5. User's Dashboard Page

The user recommendation page is the page that appears after the user inputs the priority weight criteria on the user's main page. On the recommendation page, the user can see the ranking results of property insurance companies obtained from the calculation results of the SAW method. Figure 6 is an example of recommendation results.
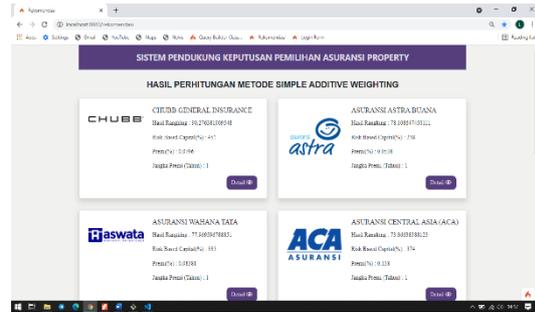

Figure 6. Recommendation Page

C. Results And Discussion

1. Determine Company Alternatives

Company alternatives in applying this property insurance decision support system use 10 alternative insurance companies. Table 2 is the company alternative.

Table 2. Company Alternative

No	Alternative	Company Name
1	A1	Asuransi Central Asia
2	A2	Asuransi Allianz Indonesia
3	A3	Chubb General Insurance
4	A4	BRI Asuransi Indonesia
5	A5	Asuransi Astra Buana
6	A6	Asuransi Wahana Tata
7	A7	Asuransi MSIG Indonesia
8	A8	BCA insurance
9	A9	Asuransi Tugu Pratama
10	A10	Asuransi Sinarmas

2. Define Criteria

In this study, four criteria were used to determine insurance companies. Table 3 is the Criteria

Table 3. Define Criteria

No	Criteria	Description	Attribute
1	C1	Risk-Based Capital	*Benefit*
2	C2	Premium	*Cost*
3	C3	Coverage	*Benefit*
4	C4	Premium Term	*Benefit*

3. Determine the Weight of the Criteria

The next process is the weighting of each criterion. The weighting is done by the user based on the priority of the desired criteria. Table 4 is wight of the criteria.

Table 4. Wight Of The Criteria.

No		Criteria	Description	Weight	Attribute
1		C1	Risk-Based Capital	40	*Benefit*
2		C2	Premium	30	*Cost*
3		C3	Coverage	15	*Benefit*
4		C4	Premium Term	15	*Benefit*

4. Making Alternative Suitability Ratings and Criteria

The next process is Making alternative suitability ratings and criteria. Table 5 is suitability ratings and criteria.

Table 5. Suitability Ratings and Criteria

No	Alternative	Criteria			
		C1	C2	C3	C4
1	A1	374	0,138	13	1
2	A2	282	0,2194	13	1
3	A3	451	0,0796	15	1
4	A4	363	1,5	9	1
5	A5	238	0,0538	12	1
6	A6	335	0,0838	14	1
7	A7	269	0,1996	14	1
8	A8	345	0,75400	7	1
9	A9	397	0,12734	10	1
10	A10	432	1,60	13	1

5. Normalize the decision matrix

Normalize the decision matrix using formula (1). Table 6 is the normalized matrix

Table 6. Normalize Decision Matrix

No	Alternative	Criteria			
		C1	C2	C3	C4
1	A1	0,829268293	0,389855027	0,866666667	1
2	A2	0,625277162	0,245214221	0,866666667	1
3	A3	1	0,675879397	1	1
4	A4	0,804878049	0,035866667	0,6	1
5	A5	0,527716186	1	0,8	1
6	A6	0,742793792	0,642004773	0,933333333	1
7	A7	0,596452328	0,269539078	0,933333333	1
8	A8	0,764966741	0,071352785	0,466666667	1
9	A9	0,880266075	0,422490969	0,666666667	1
10	A10	0,957871397	0,033625	0,866666667	1

6. Ranking Process

To get the preference value or ranking, the addition of the multiplication of the normalized matrix results in each of the criteria weights, according to formula (2). Table 7 is an alternative ranking.

Table 7. Alternative Ranking

No	preference value	Alterbative
1	Chubb General Insurance	9,027638191
2	Asuransi Wahana Tata	7,763856153
3	Asuransi Astra Buana	7,710864745
4	Asuransi Central Asia	7,219971721
5	Asuransi Tugu Pratama	7,121870542
6	Asuransi Sinarmas	6,665693921
7	Asuransi MSIG Indonesia	6,061093214
8	Asuransi Allianz Indonesia	5,970084643
9	BRI Asuransi Indonesia	5,527112195
10	BCA Insurance	5,207258651

D. *Website Performance Result*

Web development based on the SDLC concept can connect customers [10]. A sample trial of 30 trials

was carried out by inputting the priority of insurance criteria with different data to determine the website's speed. For more details, see Table 8 below.

Table 8. Website Speed Sample Data

No	Sample				Speed (ms)
	Risk-based capital (%)	Premium (%)	Coverage (%)	Premium Term (%)	
1	40	30	15	15	672
2	30	40	15	15	892
3	60	10	20	10	626
4	10	50	20	20	857
5	25	20	20	35	923
6	40	20	30	10	888
7	20	40	30	10	1.000
8	50	30	10	10	814
9	35	45	10	10	786
10	20	20	40	20	496ms
11	10	10	60	20	1.350ms
12	5	65	20	10	1.910
13	15	15	20	50	2.320
14	80	10	5	5	718
15	5	80	5	10	664
16	10	10	10	70	856
17	20	20	50	10	1.010
18	5	10	80	5	3.300
19	25	25	25	25	2.110
20	5	5	10	80	537
21	30	5	5	60	1.11s
22	85	5	5	5	2.940
23	70	10	10	10	3.530
24	30	30	30	10	2.330
25	45	5	45	5	1.290
26	10	5	80	5	820
27	10	40	40	10	624
28	5	45	35	15	653
29	10	45	45	0	1.230
30	0	30	30	40	664
Total					37920
Average					1264

IV. CONCLUSION

The results of the implementation of the tests show that:

1. The SAW method can be applied in the property insurance selection decision-making system.
2. The calculation of the SAW method shows the ranking results with the highest value are the best alternative companies.
3. The test results show that the property insurance selection application can help property owners choose an insurance company according to the property owner's criteria.
4. The calculation of website performance results indicates the average website speed of 30 experimental sample data is 1264 ms.

REFERENCES

[1] H. Intisari, P. Teori, and K. U. H. Dagang, "Metode konvolusi pada asuransi properti," vol. 03, no. 1, pp. 33–36, 2015.

[2] R. Fauzan, Y. Indrasary, and N. Muthia, "Sistem Pendukung Keputusan Penerimaan Beasiswa Bidik Misi di POLIBAN dengan Metode SAW Berbasis Web," *J. Online Inform.*, vol. 2, no. 2, p. 79, 2018, doi: 10.15575/join.v2i2.101.

[3] S. Wulandari and A. P. Wibowo, "Development Of SAW (Simple Additive Weighting) Metod For Decision Support System Of Sembako Price Control (Case Study of the Office of Agriculture, Fisheries and Forestry, Sleman Regional Government)," *Int. J. Eng. Technol. Nat. Sci.*, vol. 1, no. 1, pp. 1–8, 2019.

[4] M. dan M. A. M. B. Hidayat, "Sistem Pendukung Keputusan Untuk Pemilihan Hotel Dengan Simple Additive Weighting (SAW) Berbasis WEB," *Semin. Nas. Teknol. Inf. dan Multimed.*, pp. 6–7, 2016.

[5] S. Saefudin and E. Hendriana, "Sistem Pendukung Keputusan Pemilihan Perusahaan Pengangkutan Barang Menggunakan Metode Saw Di Pt. Indah Kiat Pulp and Paper Tbk. Serang Mill," *ETHOS (Jurnal Penelit. dan Pengabdian)*, vol. 5, no. 2, p. 304, 2017, doi: 10.29313/ethos.v5i2.2363.

[6] E. Marbun and S. Hansun, "Sistem Pendukung Keputusan Pemilihan Program Studi Dengan Metode Saw Dan Ahp," *Ilk. J. Ilm.*, vol. 11, no. 3, pp. 175–183, 2019, doi: 10.33096/ilkom.v11i3.432.175-183.

[7] I. Ramadhan and U. Zaky, "Method Comparison Analysis Simple Additive Weighting (Saw) With Weighted Product (Wp) Method in Supporting the Decision To Accept New Employees," *Int. J. Eng. Technol. Nat. Sci.*, vol. 2, no. 1, pp. 11–17, 2020, doi: 10.46923/ijets.v2i1.66.

[8] R. HAYAMI, "Aplikasi Perhitungan Harga Premi Asuransi Kebakaran Menggunakan Metode Analytic Network Process (Anp)," *J. Fasilkom*, vol. 9, no. 2, pp. 448–456, 2019, doi: 10.37859/jf.v9i2.1418.

[9] S. Sumanto, "Profile Matching Untuk Pemilihan Produk Asuransi Terbaik," *J I M P - J. Inform. Merdeka Pasuruan*, vol. 5, no. 1, pp. 10–14, 2020, doi: 10.37438/jimp.v5i1.243.

[10] A. Tri Hidayat, A. Nugroho, and S. Saifullah, "Web Development Based on Sdlc Concept Approach in E-Commerce At Basuki Jaya Pharmacy," *Int. J. Eng. Technol. Nat. Sci.*, vol. 2, no. 1, pp. 1–7, 2020, doi: 10.46923/ijets.v2i1.73.