2024 ICM
Problem E: Sustainability of Property Insurance

Photo Credit: Pixabay.com

Extreme-weather events are becoming a crisis for property owners and insurers. The world has endured "more than $1 trillion in damages from more than 1,000 extreme-weather events in recent years."[1] The insurance industry saw claims for natural disasters in 2022 increase by "115% compared to the 30-year average."[1] Conditions are expected to get worse as losses from severe weather-related events are likely to increase due to floods, hurricanes, cyclones, droughts, and wildfires. Premiums for insurance coverage are rising quickly, with climate change fueling projected increases of 30-60% by 2040.[1]

Property insurance is not only getting more expensive, but also harder to find, as insurance companies change how and where they are willing to **underwrite** policies. The weather-related occurrences propelling the cost of property insurance premiums look different depending on where you are in the world. Additionally, the **insurance protection gap** averages 57% worldwide and is increasing.[2] This highlights the industry's dilemma - the emerging crisis in profitability for the insurers and in affordability for the property owners.

COMAP's **I**nsurance of **C**atastrophes **M**odelers (**ICM**) are interested in the sustainability of the property insurance industry. As climate change increases the likelihood of more severe weather and natural disasters, ICM wants to determine how best to posture property insurance now such that there is resilience in the system to cover the cost of future claims while also ensuring long-term health of insurance companies. If insurance companies are unwilling to underwrite policies in too many cases, they will go out of business due to too few customers. Conversely, if they underwrite policies that are too risky, they may pay too many claims. Under what conditions should insurance companies underwrite policies? When should they choose to take the risk? Is there anything a property owner could do to influence this decision? Develop a model for insurance companies to determine if they should underwrite policies in an area that has a rising number of extreme weather events. Demonstrate your model using two areas on different continents that experience extreme weather events.

As we look to the future, communities and property developers need to be asking themselves how and where to build and grow. As the insurance landscape changes, future real-estate decisions must be made to ensure properties are more resilient and built deliberately, including the viability to offer appropriate services to growing communities and populations. How can your insurance model be adapted to assess where, how, and whether to build on certain sites?

There may be communities where your insurance model recommends against underwriting current or future property insurance policies. This may result in community leaders facing tough decisions about properties with cultural or community significance. For example, the Cape Hatteras Lighthouse was moved on the Outer Banks of North Carolina to protect this historic light house along with the local tourism industry centered around it.[3] As a community leader, how could you identify buildings in a

community that should be preserved and protected due to their cultural, historical, economic, or community significance? Develop a preservation model for community leaders to use to determine the extent of measures they should take to preserve buildings in their community.

Select a historic landmark – not Cape Hatteras Lighthouse – that is in a location that experiences extreme weather events. Apply your insurance and your preservation models to assess the value of this landmark. Compose a one-page letter to the community recommending a plan, timeline, and cost proposal for the future of their treasured landmark considering the insight you have gained from the results of your insurance and preservation models.

Your PDF solution of no more than 25 pages total should include:

- One-page summary sheet that clearly describes your approach to the problem and your most important conclusions from your analysis in the context of the problem.
- Table of Contents.
- Your complete solution.
- One-page community letter.
- AI Use Report (if used).

Note: There is no specific required minimum page length for a complete ICM submission. You may use up to 25 total pages for all your solution work and any additional information you want to include (for example: drawings, diagrams, calculations, tables). Partial solutions are accepted. We permit the careful use of AI such as ChatGPT, although it is not necessary to create a solution to this problem. If you choose to utilize a generative AI, you must follow the COMAP AI use policy. This will result in an additional AI use report that you must add to the end of your PDF solution file and does not count toward the 25 total page limit for your solution.

References

[1] Boston Consulting Group. (2023, December 4). An Insurance Risk Framework for Climate Adaptation. Retrieved at: https://www.bcg.com/publications/2023/an-insurance-risk-framework-for-climate-adaptation

[2] Munich RE. (2022, January 10). Hurricanes, cold waves, tornadoes: Weather disasters in USA dominate natural disaster losses in 2021. Retrieved at: https://www.munichre.com/en/company/media-relations/media-information-and-corporate-news/media-information/2022/natural-disaster-losses-2021.html

[3] Union of Concerned Scientists. (2016, July 19). Saving an Icon: Moving the Cape Hatteras Lighthouse Away from the Shifting Shoreline. Retrieved at: https://www.ucsusa.org/resources/moving-cape-hatteras-lighthouse-away-shifting-shoreline

Glossary

Insurance Protection Gap: the difference in protection coverage between economic losses brought about by natural disasters and the amount of those losses that are covered.

Underwrite: accept liability for, thereby guaranteeing payment in the case of loss or damage.

Use of Large Language Models and Generative AI Tools in COMAP Contests

This policy is motivated by the rise of large language models (LLMs) and generative AI assisted technologies. The policy aims to provide greater transparency and guidance to teams, advisors, and judges. This policy applies to all aspects of student work, from research and development of models (including code creation) to the written report. Since these emerging technologies are quickly evolving, COMAP will refine this policy as appropriate.

Teams must be open and honest about all their uses of AI tools. The more transparent a team and its submission are, the more likely it is that their work can be fully trusted, appreciated, and correctly used by others. These disclosures aid in understanding the development of intellectual work and in the proper acknowledgement of contributions. Without open and clear citations and references of the role of AI tools, it is more likely that questionable passages and work could be identified as plagiarism and disqualified.

Solving the problems does not require the use of AI tools, although their responsible use is permitted. COMAP recognizes the value of LLMs and generative AI as productivity tools that can help teams in preparing their submission; to generate initial ideas for a structure, for example, or when summarizing, paraphrasing, language polishing etc. There are many tasks in model development where human creativity and teamwork is essential, and where a reliance on AI tools introduces risks. Therefore, we advise caution when using these technologies for tasks such as model selection and building, assisting in the creation of code, interpreting data and results of models, and drawing scientific conclusions.

It is important to note that LLMs and generative AI have limitations and are unable to replace human creativity and critical thinking. COMAP advises teams to be aware of these risks if they choose to use LLMs:

- Objectivity: Previously published content containing racist, sexist, or other biases can arise in LLM-generated text, and some important viewpoints may not be represented.
- Accuracy: LLMs can ‘hallucinate’ i.e. generate false content, especially when used outside of their domain or when dealing with complex or ambiguous topics. They can generate content that is linguistically but not scientifically plausible, they can get facts wrong, and they have been shown to generate citations that don’t exist. Some LLMs are only trained on content published before a particular date and therefore present an incomplete picture.
- Contextual understanding: LLMs cannot apply human understanding to the context of a piece of text, especially when dealing with idiomatic expressions, sarcasm, humor, or metaphorical language. This can lead to errors or misinterpretations in the generated content.
- Training data: LLMs require a large amount of high-quality training data to achieve optimal performance. In some domains or languages, however, such data may not be readily available, thus limiting the usefulness of any output.

Guidance for teams

Teams are required to:

1. **Clearly indicate the use of LLMs or other AI tools in their report,** including which model was used and for what purpose. Please use inline citations and the reference section. Also append the Report on Use of AI (described below) after your 25-page solution.
2. **Verify the accuracy, validity, and appropriateness** of the content and any citations generated by language models and correct any errors or inconsistencies.
3. **Provide citation and references, following guidance provided here.** Double-check citations to ensure they are accurate and are properly referenced.
4. **Be conscious of the potential for plagiarism** since LLMs may reproduce substantial text from other sources. Check the original sources to be sure you are not plagiarizing someone else's work.

COMAP will take appropriate action when we identify submissions likely prepared with undisclosed use of such tools.

Citation and Referencing Directions

Think carefully about how to document and reference whatever tools the team may choose to use. A variety of style guides are beginning to incorporate policies for the citation and referencing of AI tools. Use inline citations and list all AI tools used in the reference section of your 25-page solution.

Whether or not a team chooses to use AI tools, the main solution report is still limited to 25 pages. If a team chooses to utilize AI, following the end of your report, add a new section titled Report on Use of AI. This new section has no page limit and will not be counted as part of the 25-page solution.

Examples (this is *not* exhaustive – adapt these examples to your situation):

Report on Use of AI

1. OpenAI *ChatGPT* (Nov 5, 2023 version, ChatGPT-4)
   Query1: *<insert the exact wording you input into the AI tool>*
   Output: *<insert the complete output from the AI tool>*

2. OpenAI *Ernie* (Nov 5, 2023 version, Ernie 4.0)
   Query1: *<insert the exact wording of any subsequent input into the AI tool>*
   Output: *<insert the complete output from the second query>*

3. Github *CoPilot* (Feb 3, 2024 version)
   Query1: *<insert the exact wording you input into the AI tool>*
   Output: *<insert the complete output from the AI tool>*

4. Google *Bard* (Feb 2, 2024 version)
   Query: *<insert the exact wording of your query>*
   Output: *<insert the complete output from the AI tool>*