2011

Ensuring Insurers - Insurance Profiler (InsPro)

White Paper, Insurance

Nishant Sinha
Pitney Bowes Software India
18/01/2011

White Paper, Insurance

Ensuring Insurers - Insurance Profiler (InsPro)

Nishant*, Neena Priyanka, Madhumita Mund Rao, Pitney Bowes Software India Pvt. Ltd (Formerly MapInfo and Group 1), Sector-62, Noida- 201307

* **Corresponding Author**

mailto:nishant.sinha@pb.com?subject=InsPro

Introduction

Risk analysis is a complex task that entails the consideration of complex parameters which are difficult to interpret and quantify (Tabuchi and Sanders, 2006; Zolfaghari, 2008**)**. In addition, risk analysis involves a comprehensive database to model the uncertainty and vagueness. As a consequence, insurers/reinsurers fail to evaluate and underwrite the actual risk.

The disaster risk scenario in India can be described as high (Refer Figure 1) owing to an elevated probability of hazard occurrences and high exposure due to geographical, topographical and socio-economic settings (EM-DAT, 2010). India's vulnerability to natural catastrophes coupled with rapid growth and transformation of the insurance market, it's crucial to address this context of high level vulnerability in order to avoid the present scale of losses and damage. This is crucial for monitoring

of accumulations; risk based pricing, underwriting and claims management for booming sector such as Insurance.

"Insurance is a risk transfer mechanism, whereby the individual or the business enterprise can shift some of the uncertainty on to the shoulders of others, in return for a known premium; usually a very small amount compared with the potential loss, the cost of that loss can be transferred to an insurer (Dickson, 2005)." Despite leveraging such transfer of risk through integrated product choices and schemes, there are very limited sections of population (0.5%) in India those have any kind of insurance (IRDA, 2009). However, the problem encountered in Indian context, is the availability of small fraction of the data viz. spatial & non-spatial and that too in discrete and dispersed manner. In many cases, complexities and inconsistencies in the assignment of physical address to specific latitude/longitude not only challenge the ability of an insurance company to accurately assess the correct location, they also fuel errors resulting in overpayment and underpayment. Beside these, several other reasons which could be attributed for such low profiling includes a general lack of awareness, two-dimensional nature of spreadsheets and reports which requires skill

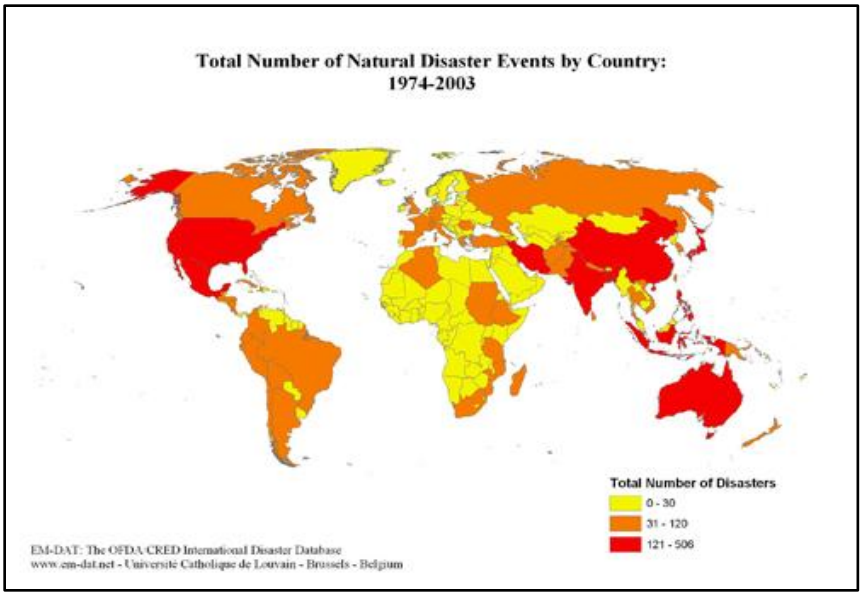

Figure 1: Country-wise total natural disaster events (Source: EM-DAT)

set for understanding, lack of spatial database that could provide easy visualization and data querying, absence of scientifically designed enterprise solutions focused for Insurance underwriters to promote faster and effective decision making.

Considering this, adoption of geospatial technology for niche areas such as actuarial underwritings, claims management, risk based pricing could be very useful as much of the data required within these domains contains geographic component. The geospatial components provide sophisticated visualization and database management support thereby facilitating easy location of the insured points and risk zones as well as exploratory analysis of spatial data. Traditional GIS and Remote Sensing, if used alone, has limited functionality due to poor incorporation of intelligence and spatial statistics (Lianfa *et al*., 2005; Rabkin, 2010). Therefore, a Spatial Decision Support System (SDSS) is required to support disaster insurance pricing that involves procedural and declarative knowledge. The libraries of statistics - spatial and non-spatial, visualizations and database management provide a robust mechanism for risk analysis including spatial correlation between zones vulnerable to hazard and spatial variation of exposures. This will even allow risk assessment with regard to mapping out hazard concentration, degree of vulnerability, exposure ratio, what is affected and degree/nature of affect. In the current SDSS, the knowledge-based system shell, using the geocoding engine, supporting fuzziness and uncertainty algorithm three phases of actuarial solutions are addressed viz. identification risk location, fuzzy comprehensive evaluation of risk, and query for insurance underwritings alongwith actuarial pricing.

Objectives

The conventional Insurance underwritings, risk pricing and claims management has varied gratuitous postulations viz. normal disaster activity, stable population demographics, stable insured losses and little effect of change in coverage pricing with change in asset parameters upon the risk, pertaining to risk evaluation. Besides, there are various other inadequacies such as poor location identification of the insured exposures on paper maps, primitive modeling assumptions and slow update of information that add to the complexity of insurers/reinsurers. Such limitations aid to the underestimation of the severe nature of the disaster and associated potential loss resulting in failure and insolvency, unexpected significant drop in surplus and bankruptcy of insurance companies. With this backdrop, the objectives formulated for the current study was to develop a geo-intelligence insurance based solution which would minimize uncertainty and cater to the needs of the Insurers, underwriters and risk managers for profiling overall scenario of property risk in their actuarial assessment.

SDSS solutions for actuarial Industry - Conceptual design and System architect

Recognizing shortcomings of Insurance sectors, new practices and new pricing methods and techniques have been adopted by experts amongst whom geospatial techniques plays an important role.

Geospatial technology provides excellent visualization, timely information dissemination and management of spatial/non-spatial information, provides access to geospatial and socioeconomic databases & tools and other ancillary analytical tools. The integration of geospatial techniques with web-based mapping solutions has revolutionized the geospatial industry. This act raises the hope for many more such revolutionary changes that are likely to bring in more excitement to the Insurance industry. One such novel breed of combo-product i.e. pooled benefit of visual display of geographic and risk reporting based on scenario generations, is conceptualized Web based application for Insurers i.e. ***Insurance Profiler (InsPro)***.

Insurance Profiler (InsPro) is an insurance risk profiling solution that utilizes geospatial technologies to improve identification, assessment, pricing and monitoring of risk across various lines of business (Refer Figure 2). It provides business users with an integrated view of geography, associated vulnerability scores, historic claims (if any) and business data at pincode/building resolution (whichever is available) for the entire country. Insurers that once relied on manual research or ineffective location data look-ups can find accurate, cost efficient tool now in reach within an integrated system having capability to provide exact location

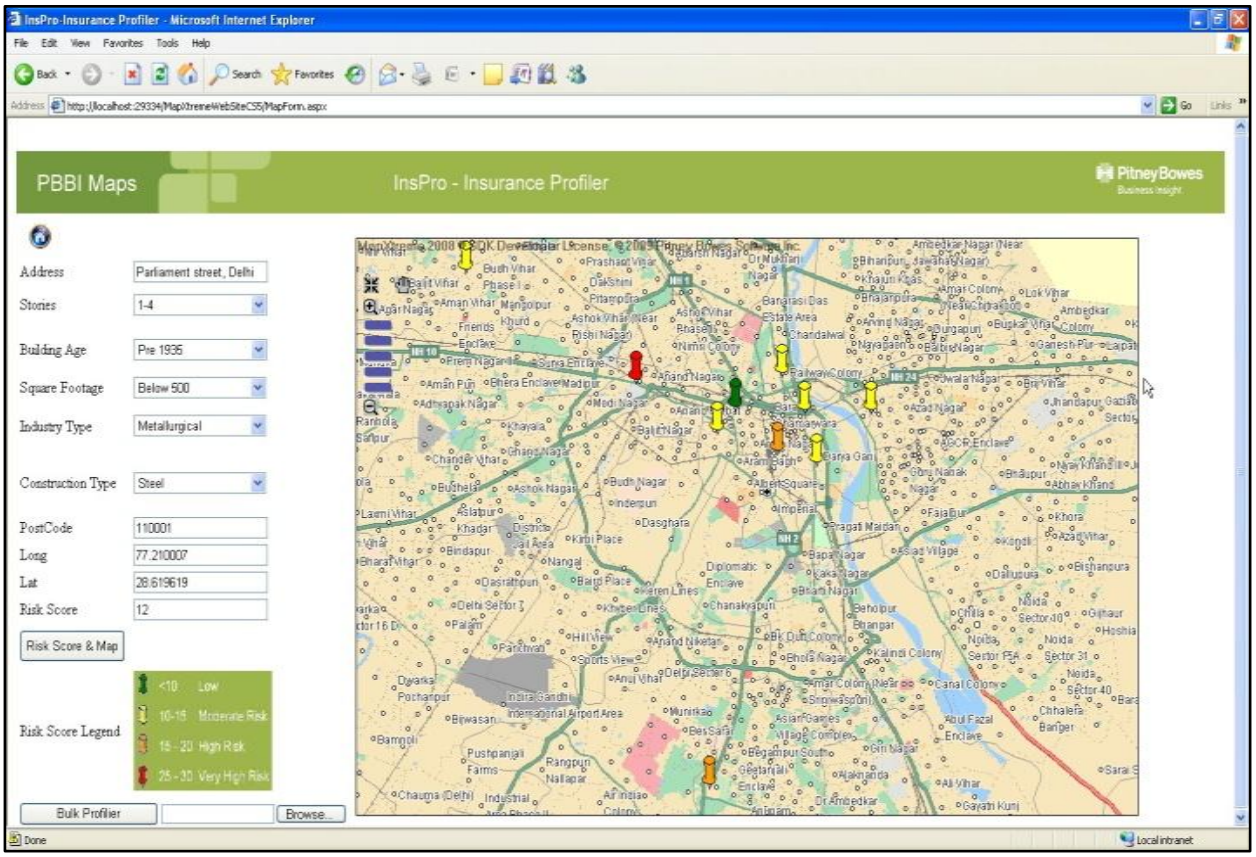

Figure 2: *Insurance Profiler (InsPro)* - Web based enterprise solution for Insurers/Re-insurers
(Source: PBBI India Pvt. Ltd)

and perform risk analysis simultaneously. Market leaders have adopted best practices that make it easier to take advantage of up-to-date data and precise assignments whenever and wherever needed. This tool provides a more economic approach to much-needed accuracy and helps ensure the insurers in terms of address location and risk profiling. This suite of services is centered on two basic components: **Geocoding** and **fuzzy comprehensive risk algorithm**.

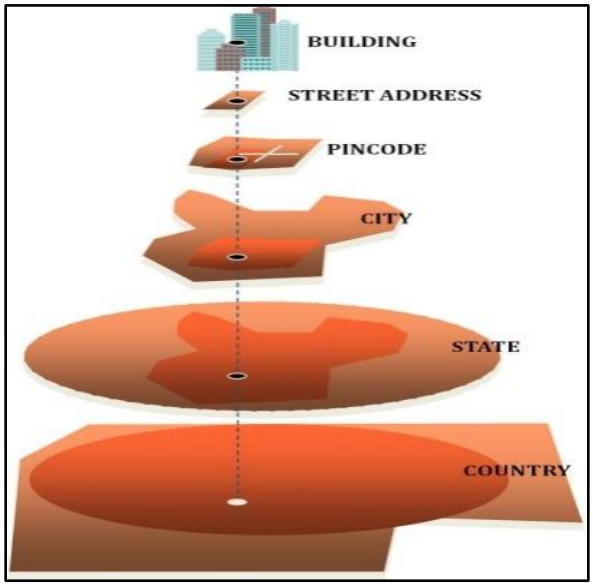

Figure 3: Various level of Geocoding resolutions

Property underwriters must be acquainted with as much as possible information about the risk associated with the property itself (such as proximity to risk regions, routes to assist during risk, distance to neaby facility etc. The better picture that an insurer has of region, the better the insurer can assess risk and price products meeting customer expectations, profitably. Thus, amalgamation of Geo-intelligence with the actuarial science is must for creation of such analytical SDSS. With this backdrop, **Geocoding engine** was designed as first "gateway" into InsPro application. Before a risk scoring algorithm processes a location for underwriting, the geocoding match level determines the type of analysis an individual location can support. As a result, locations are then geocoded at some level to be compatible with model data and non-geocoded addresses do not return score results at all. Generally, these steps include parsing the input address into address components viz. street name, street type, etc., standardization of the abbreviated values, assigning each address element to a match key, indexing of the needed categories, searching the reference data, assigning a score to each potential candidate, filtration of the list of candidates based on the minimum match score, and delivering the best match. The address match level determines the level of resolution of the analysis and the associated score lookups. This has a direct effect on modeled scores, because results for a single location may vary substantially at different geocoding resolutions (Refer Figure 3). Hence, the precision of a geocoded address has been considered as one of the strongest influences in this SDSS based risk score application. The address geocoded is at the lowest level of data granularity available in the region.

The **fuzzy comprehensive risk algorithm system** is designed using fuzzy inference system which is a popular computing framework based on the concept of fuzzy is set theory, fuzzy if – then rules, and fuzzy reasoning. The integrated system first matches the physical address information to longitude and latitude coordinates using Geocoding engine and get with an exact location which is then exposed to building vulnerability parameters fuzzy logics model and henceforth risk scores are generated at location level based on set of fuzzy rules. This

step form the second gateway of a multi-phase procedure for identifying risk of the

The purpose is more of visionary kind that is to draw people who have never bought

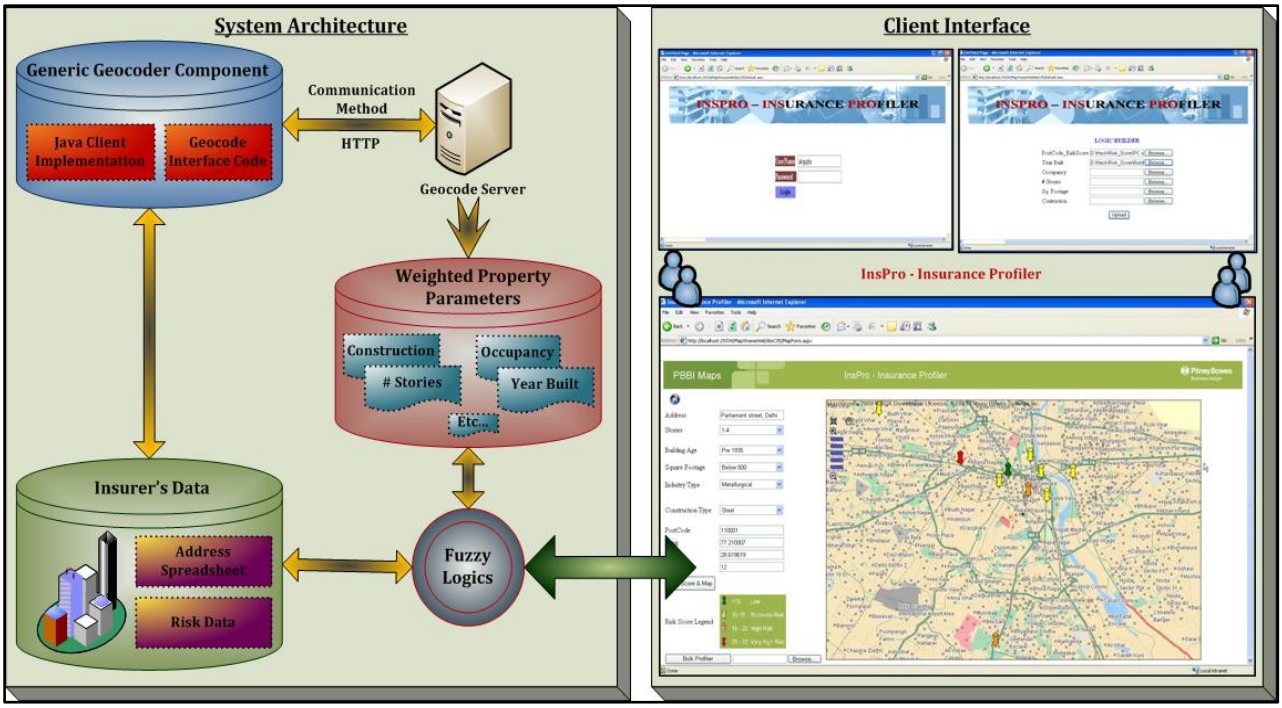

Figure 4: Schematic Architecture of InsPro

propery asset which is then analyzed in details (such as claims historic trends and records etc) in order to decide on underwritings and risk based pricing (Refer Figure 4 for Schematic diagram of SDSS Architecture).

The SDSS has flexibility for calibrating data using AHP, the parameters and even risk computation logic and limits, as per user's requirement. Beside these, the better visuals and array of the applications has capability to draw more acute fascination of the customer toward the insurance underwritings/pricing. The application will tend to bring in the uninsured segment of population into the insured segment by giving a logical view of where and why the asset should be insured.

insurance to accept insurance as the best risk management instrument.

InsPro - Solution offerings

Insurance underwritings, risk pricing and claims management are a number of objectives by which an insurer can reduce the volatility in the risk characteristics of the risk to 'homogenize' it, and make it fall in to the basket of the 'risk pools'. The booming geospatial technological have made possible to build geo-analytical custom insurance solutions that leapfrog the capabilities of traditional offerings. ***InsPro – Insurance Profiler*** is an upshot of such offerings, coming out with hitherto hard-to-obtain location data with integrated risk scores. Some of the offerings are enlisted below:

- **Assessment of spatio-temporal hazard risk patterns**

  This refers to the frequency and intensity distributions of hazard risk in geographic space and their correlation with building parameters which are then used to predict actual risk and categorize the building on risk scale. Due to the vagaries of natural hazards, their occurrence has no direct relation to past claims so the claims-based methods often cannot accurately classify the risk and predict the loss potential, in particular of rare large hazards occurrence in that particular region. On the contrary, the spatial decision support system can provide comprehensive analysis of hazard based risk score in addition to building parameters to produce more objective patterns of risk assessment in support of the expert knowledge base.

- **Evaluation of spatio-temporal variation of exposure**

  Exposure pertaining to current SDSS refers to property exposed to hazards and at risk of loss. The spatial variation is a major component of insurance pricing. Discrepant insured buildings have differential spatial variation of loss risk and thereby have their respective vulnerability and loss curve. Further, it is necessary to correctly estimate the regional total loss at risk from all kinds of properties so as to classify the insurance portfolios.

- **The past claims and their correlation by different policies**

  Although the past claims data alone can't provide enough accurate information concerning the occurrence patterns of natural hazards, they are an available indicator for the vulnerability and loss curve of exposures and contain important information for pricing. Therefore, they are significant information sources for determining insurance rates.

- **Mapping**

  Underwriters can examine specific regions on a digital map to see, how much of the current book of business is concentrated within a given radius or is proximal to historical claim records? This would give them a clear picture of the potential risk of the specific building/ pincode/ regions. Visualizing property information on a map makes a whole lot of difference.

- **Analytics**

  Trend analysis with historical data can be performed to determine if a zone presents an unacceptable risk for insuring new industry in the area. Or by varying parameters of building contents, a new risk can be pre-screened by the underwriter. If the new risk falls in the alarming range of score, it means there is already a concentration of risks, and they should be careful while writing risk based on the current guidelines.

- **Uncertainty and other factors**

  Other factors, such as quantity and quality of geospatial data, modeling methods and uncertainty from them, also produce important effects upon pricing in terms of fairness and accuracy. So estimates of uncertainty from data and models should be provided for users with the results. Considering the above multiple factors, insurance pricing of natural disasters is a complex process that involves disparate domain knowledge and multidisciplinary collaboration. It is suggested that a Insurance based spatial decision support system such as InsPro can provide with integrated tools that incorporate domain expert knowledge and facilitates geo-visualization and spatial analysis for pricing .

Given the close association of geography with Insurance decision making processes, InsPro application is perfectly suited to the insurance domain.

Conclusion

Natural disaster and its vagaries contribute to complexity of the risk analysis. Insurance pricing of these involves manifold factors and interdisciplinary cooperation between disaster experts, meteorologists and actuaries. From the initial phase of hazard simulation, vulnerability and risk analysis to rate-making and premium-making, there is no clear-cut method or model that can give a comprehensive answer. The location based knowledge system designed specifically to deal with situation involving procedural and declarative knowledge is thus an appropriate choice of technology. The SDSS - ***InsPro*** conceptualized in this document incorporates the advanced expert-system shell, sophisticated visual GIS and robust spatial fuzzy statistics components into a coherent and integral system using the industry standard interface protocol, MapExtreme. Such a system is flexible, portable, extendable, low-cost and effective to provide a solid base for more accurate risk analysis and pricing of insurance policies. The application based on the actuarial and insurance guiding principles and scientific risk assessment considerations, has the potential to basically transform the lifecycle of most of the Insurance business processes as known in the present day. Because of its flexibility, scalability, user-friendliness GUI, despite some shortcomings (hazard assessment, unsystematic uncertainty analysis), the SDSS can be easily enhanced and become more powerful with continuous update of knowledge bases and incorporation of developed risk models in support of the geocoding/statistical engines. This suite of product developed as prototype for Insurance sector, can also customized for various other spatial fields.

Acknowledgement

The authors would like to acknowledge the contributions of Akhil Gupta, Mohammad Tassavur Jamal, Kailash Mishra, Sujai Harichandran, Rajesh Dhull, Rahul Tyagi and Santonu Kumar Deb of PBBI for their willingness to commit the time and effort involved in designing, implementation, compilation, application development, criticizing and evangelizing the InsPro. The authors would like to acknowledge Dr. P K Joshi of TERI University for his constant guidance, throughout the Ph.D. work toward

conceptualizing this SDSS. At last but not the least, sincere thanks to Mr. Ajay Gupta, AVP-Zonal Head, Commercial U/W, Bharti Axa General Insurance Company for giving the business case and guidance throughout the development.

About the authors

Nishant is a Project Manager with PBBI Data Dev with 12 years of GIS and Remote Sensing experience. He is currently pursuing Ph.D. in Catastrophic Risk Insurance Assessment using GIS from TERI University, New Delhi. He has worked for Risk Management Solution (RMS), CA on Exposure data for Catastrophe Risk Modeling of US. *nishant.sinha@pb.com*

Neena Priyanka is a Data Specialist with PBBI Data Dev. She has been working in the field of GIS and Modeling. She is persuing her Ph. D. in GIS modeling from TERI University, New Delhi. She has worked in Risk and Insurance domain for more than 2 years.
neena.priyanka@pb.com

Madhumita Mund Rao is Director-Data and heading the Data Dev. group at PBBI. She has 16 years of experience in spatial and non spatial data analytics. *madhumita.rao@pb.com*

References

Dickson, David C. M. **2005**. Insurance Risk and Ruins. International Series on Actuarial Science. Cambridge University Press. 233pp

EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.be, Université Catholique de Louvain, Brussels (Belgium);(accessed on 11 January, **2010**)

Li, Lianfa; Wang, Jinfeng and Wang, Chengyi. **2005**. Typhoon insurance pricing with spatial decision support tools. *International Journal of Geographical Information Science*. Vol. 19 (3): 363–384pp

Rabkin, Barry and Sonnen, David. **2010**. Frameworks to Develop Spatial Perspectives of the Insurance Value Chain. *IDC Technology Spotlight.* IDC 1043: 1-8

Tabuchi, Shigeko and Sanders, Richard. **2006**. Current and emerging insurance markets – earthquake models and risk transfer technology. First European Conference on Earthquake Engineering and Seismology, Geneva, Switzerland, 3-8 September 2006. Paper Number: 1287. 1-9pp

Zolfaghari, M.R. and Campbell, K.W. **2008**. A new insurance loss model to promote catastrophe insurance market in India and Pakistan. The 14th World Conference on Earthquake Engineering October 12-17, 2008, Beijing, China. 1-8pp

Disclaimer