Floods and Droughts: Making Sense of Disaster

Trying to make sense of disaster – one man at the University of the Free State (UFS) dedicated his life's work to answering questions about disasters; what causes it, the extent of damage and disruption, the probability of similar disasters happening in future and measures that could be taken to prevent or minimise the disruption and damages should such a disaster recur.

His name is Prof. Giel Viljoen and the crowning glory on his research spanning 25 years, was delivering the F.R. Tomlinson Commemorative Lecture on 24 May 2002 at Ilanga Estate, Bloemfontein.

"Too much or too little water: research dedication and lessons for new generation agricultural economists" was the title of his paper which focused mainly on the determination and management of the economic impacts of too much water, or floods on the one hand, and too little water, or droughts on the other. The paper gave an overview of the research that he and his research teams conducted over the years.

"My interest in flood and drought impact research started in 1975, after abnormally high rainfall during 1974 over large parts of South Africa. This rainfall pattern continued until the early eighties, but was quickly followed by a dry spell caused by abnormally low rainfall in various parts of the country and the imposition of water restrictions from 1983 to 1987," explains Prof. Viljoen.

But, following the principles of sensible research, let us start at the beginning. The first genuinely scientific research into flood impact assessment in South Africa started in 1975 after extensive flooding in 1974 in the central interior. The Department of Water Affairs requested the Water Research Commission to approach the Institute for Social and Economic Research (ISER) at the University of the Orange Free State and the Bureau for Economic Investigation at the University of Stellenbosch to conduct a joint scientific investigation into the nature and extent of the damage caused by the floods. Prof. Viljoen, then a senior lecturer with a Masters in Agricultural Economics under supervision of Prof. Dirk Smith, headed the UOFS research team. This opportunity also gave him the perfect start to his doctoral thesis, which he completed in 1979. This initial exploratory phase, completed in the early eighties proved invaluable for follow-up research in the 1990's.

Says Prof. Viljoen: "The data obtained during the ex-post phase were not sufficient to construct a complete set of loss functions needed for flood control planning, so it was decided to start the next phase of ex-ante research which would render it possible to construct loss functions without floods actually occurring. Unfortunately, we had to postpone this research, because the interior of the country was entering a dry phase with abnormally low rainfall."

"The widespread drought necessitated water restrictions. Once again, the Water Research Commission approached three different institutions to research the nature and extent of the socio-economic and financial effects of water restrictions. Again the ISER became involved, along with the Bureau for Market Research at the University of South Africa and the Centre for Applied Social Research at the University of Natal. By that time, I was promoted to professor and headed this operation from the UOFS'side. The three bodies worked together on one research area, stretching from the Ngagane River state water scheme, the Umgeni catchment area, the Riet River state water scheme, the Vaalharts state water scheme and the Vaal River system, each concentrating on a different sector."

The research on water restrictions was another first for South Africa; consequently a research methodology had to be developed. Fortunately, the methodology developed in the flood damage research could be reformulated and adjusted to be applicable to the restricted water situation. After the conclusion of the research by the three bodies, the ISER was asked to compile a summative report on the findings of the three bodies for the period 1983 to 1985. They also wrote a report on the total financial consequence of the water restrictions during the period that the restrictions were in place.

"Many important and interesting findings came out of this research, such as calculating the average worth of water in different sectors – useful when estimating different intensities of water restrictions in various sectors. The loss function concept, developed during the flood damage research, was also expanded and adjusted to be applicable to the Vaalharts irrigation area," says Prof. Viljoen.

The rain returned and South Africa experienced more extensive flooding in 1988. The Water Research Commission provided funds to the Department of Agricultural Economics at the University of the Free State to start the ex-ante phase of research, which had to be postponed in the eighties.

One of the most important outcomes of this research was the development of a computer simulation program, named FLODSIM for the irrigation regions in Upington, the Orange River and Vereeniging on the Vaal River, which was exceptionally hard hit by the floods. Another model, ANUFLOOD, developed by the Centre for Resource and Environmental Studies at the Australian National University in Canberra was adapted in cooperation with Australian researchers for urban areas in South Africa. Research was expanded to include the Mfolozi sugar cane production area in KwaZulu-Natal, the Uitenhage and Despatch formal urban areas along the Swartkops River and the Soweto on Sea informal urban area along the Chatty River in the Eastern Cape. Another computer programme, named TEWA, a GIS programme using the same information as ANUFLOOD, took form.

In the late 90's, the process to develop a new Disaster Management Act for South Africa commenced. This Act, which would make provision for a pro-active, national flood management policy will be accepted by Parliament later this year. The new Act requires that structures be put in place to manage natural and human made disasters. With this in mind, a focused attempt at transferring technology was launched to raise awareness among role players and authorities of the technological aides available to assist them in their planning. The computer models, FLODSIM, TEWA and FLODCAL – a computer-based questionnaire – all originated from the research that Prof. Viljoen conducted over the years.

His latest undertaking is managing a postgraduate disaster management training programme, with a solid focus in supplying disaster managers with the skills they need to comply with the requirements of the new Act and the ability to deal with disasters in whatever form.

His accomplishments are numerous, but he remains humble about his success. In his view, his greatest accomplishment is not the many useful computer models and important findings that emerged from his research, but the fact that he was privileged to successfully lead many multi-disciplinary research projects and that he was able to develop something that is of practical use in the real world.

Prof. Viljoen is a well-traveled man, and his expertise in his field becomes evident when one sneaks a look at his passport. Many foreign research visits were undertaken since 1976 with a visit to the United Kingdom and the United States in connection with flood damage research. Since then he has also visited Israel, many countries in Europe, Australia, New Zealand, Ethiopia and Thailand; all in the name of research. His busy academic and research schedules, has left little time for his hobbies, which include tennis, karate, and leather- and woodcraft. He is also an avid rugby, tennis and golf spectator.

This grandfather of four still has many research ambitions that he wants to achieve before retirement. Although he has extensive experience as a manager, including positions such as head researcher and later acting director of the ISER, chairman of the ISER management, chairman of the Unit for Agricultural Management Training and Research and head of the Department of Agricultural Economics at the University of the Free State, his first love remains research. He still dreams of creating an even more sophisticated flood and drought management model; of leaving a legacy that will make the growing threat of droughts and floods a little less daunting.

"Research is never complete. Once you have found certain answers to questions, it leads to even more questions that can only be answered through more research. The earth's climate is changing, which will result in more droughts and more floods. I currently serve on the Drought Task Group of the International Commission of Irrigation and Drainage (ICID). They requested that more research is done on managing droughts as more and more countries suffer from water shortages. I am the coordinator of a group that is currently developing measures to manage irrigation droughts. Floods will always be a global reality, but droughts will cause more and more crises worldwide," he says as he dons his characteristic beret and gathers his briefcase, on his way to lead another gathering of researchers.