

From Bayesian Modelling to Saddam's Kurdish Genocide

Inaugural Professorial Lecture

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Summary:

I will try to show the power of multidisciplinary statistical modelling in contributing to the process of decision making in areas of Market modelling, econometrics, engineering, health care and social sciences with specific attention given to Bayesian statistics and ending with Saddam's genocide of the Kurdish community as part of my life experiences.

It is always a challenge to present a piece of work to a targeted audience in a concise, smooth and yet understandable tone. It is even more challenging to present multiple challenging tasks performed in ones long academic career to keep the audience interested and yet do justice to the material especially since they represent a mirror image of my personal life in diversity and eventfulness.

I start and finish where I started my life journey. Kurdistan, where as a teenager, I made every effort to be a useful and productive member of the society by learning from my surroundings and give back as much as I could. I elaborate on my opportunities of studying chance as a science and using statistics as a platform and as a tool to broaden my skills and record my contributions in a multi-disciplinary fashion in areas of statistical modelling, Market modelling, business, econometrics, engineering, health care and social sciences. I attempt to highlight examples of published and refereed work without going into details in the hope of keeping everyone interested.

Introduction

As a teenager living on the boundaries of Sulaimani City, our district was constantly subjected to military activities between the Iraqi army and the Kurdish freedom fighters. Time after time, ran for my life with the rest of my family often in the middle of night as a result of long and medium range bombardments and the Russian Mig fighters bombarding our villages.



Figure 1 Mediterranean map with my area pointed



Figure 2 Location of my home on the map

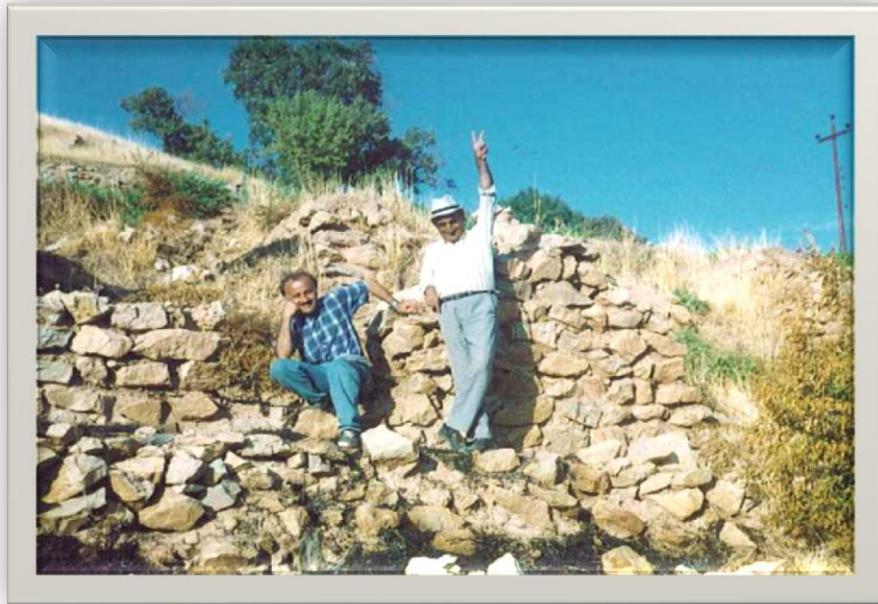


Figure 3 My Parent's ruined home

With no Nintendo and electronic games of the day, no internet and no fancy mobiles, the only attractive objects I found around myself, were the remains of the bullet shells thrown after their use. Despite their ugliness, they looked nice as, apparently, they were made of quality Brass. I started collecting them and using very primitive tools, I made teaspoons out of them and distributed them to family relatives and friends as souvenirs. As a Chief Engineer, my uncle presented a few of those teaspoons to a team of European experts visiting Sulaimani at the time with pride explaining to them how his nephew has turned the bullet shells into something useful for the society! Since then, my objective has been to turn often unpleasant scenarios around me into pleasant ones and learn from them for the future. This social phenomenon has been a pillar in my life and has made me an expert in turning failures into success even in my scientific career.

With passion for science, I knew that I had to get out of my skin and broaden my knowledge from my small district; the BBC World Service soon became my good companion. I well remember following word by word, the news of the first man (Yuri Gagarin) to journey into outer space from my portable little radio in the fields. It also gave me the first best window to lay the basis of my English language.

In my undergraduate university career, I was hoping to study physics and my lecturers sensed my intuition and ability and encouraged me to pursue that line but in Baghdad University at the time, I had very little knowledge of the Arabic Language and all the lecturers there were native Arabs while I was from a completely dominated Kurdish city. Arabic language acted as a barrier and pushed me to study Mathematics as I felt it has its own language. So, I studied Mathematics but with a constant passion for applied sciences.

This worked well for me as after completing my course requirements for an MSc in Mathematics, I worked on a Mathematical Statistics topic in “Statistical Distribution Theory” and managed to solve a conjecture that was on Gumbel type distributions and my work was published in the Mathematical Review.

During my work at a university in my city, Sulaimani, I started communicating with British Universities with a focus on Warwick and the LSE and received admission letters from both at different years while my travel permission was getting blocked for well-known non-academic reasons. I finally and proudly ended up at Warwick University as they hosted me much better than the LSE.

My Golden Period

Warwick was then known as the BBC for the British Bayesian Centre and again luckily and without much choice, I started learning from my great lecturers that Bayesian Statistics is not only a set of formulae as may unwisely be represented by a simple conditional probability statement:

$$P(A_2 \setminus A_1) = \frac{P(A_1 \setminus A_2)P(A_2)}{p(A_1)}$$

Or

$$P(A_1)P(A_2 \setminus A_1) \equiv P(A_1 \setminus A_2)p(A_2)$$

1

This simply is saying that if A_1 and A_2 are two events within the same set of events, the probability of the occurrence of either of them conditional on the occurrence of the other, multiplied by the probability of the occurrence of the other, would be identical if the events were switched over.

This identity can be worked out from the very basic principles of probability and as Einstein once said “Everything should be made as simple, but not simpler”, it cannot be made simpler! But the depth of its implications and practical use is almost unlimited.

An alternative representation of the identity (1) is:

$$Prior * Likelihood \equiv Posterior * Predictive$$

$$f(\theta)f(y \setminus \theta) \equiv f(\theta \setminus y)f(y)$$

Where:

Prior: The state of knowledge represented through experts and other source of information on the event before it happens;

Likelihood: observed state of knowledge conditional on what is already available;

Posterior: The revised state of knowledge after learning from what is observed;

Predictive: Expected next state of knowledge.

This evolution is expressed below pictorially:

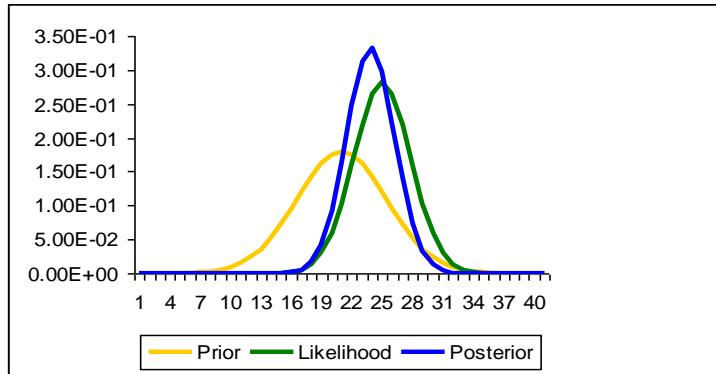


Figure 4 Prior to Posterior evolution of probability distributions

These lay down the basic foundation of a scientific learning system based on the rules of probability. In effect, it explains the mathematics of the banner (You Live.....You Learn) that is used by Glamorgan University. Furthermore, its boundaries of application span over many issues including a logical combination of the paradigms of subjectivity and objectivity and qualitative and quantitative knowledge through modelling that have continued to be in the centre of scientific debate.

Modelling in a simple sense is an attempt to design a miniature version of the process of interest so that its properties and behaviour could be investigated. From the two different philosophical angles of determinism and non-determinism, many scientists believe in a single “true” model for a state of nature. In response to a major research article presented in a Royal Statistical Society meeting, I set the properties of a model (Ameen 1995) to be:

1. Satisfactory in performance relative to the stated objective,
2. Logically sound,
3. Representative,
4. Questionable and subject to on-line interrogation,
5. Able to accommodate external or expert information and
6. Able to convey information.

Unless they are mis-specified in terms of one or more of these properties, all models are acceptable but even so, some models are more acceptable than others.

This definition and model subjectivity statement has been refereed by researchers several times in the literature.

In modelling, one of the main objectives has been the development of “simple” models inspired by the establishment of linear relations between controlled variables and uncontrollable but possibly related ones again for the purpose of understanding and control.

This is statistically represented by:

$$y = ax + b + \epsilon$$

Where x and y are the controlled and uncontrollable variables respectively, a and b are constants to be estimated from the observed data and ϵ is a random deviation variable having a probability distribution, often normal with zero mean and a constant variance.

Whether considered as a single variate or a multivariate, it forms a simple linear static model which has been popular in diverse fields of applications like economics and social sciences and almost all the works of the father of classical statistics, RA Fisher (1890-1962), has been based on this assumption despite its simplicity. As Einstein once requested to keep it simple but not too simple this is often too simple because real life could often be much bumpier than what we expect. Such models often overlook the dynamic and evolving nature of the world we live in including ourselves, our knowledge and our understanding of issues around us.

My work at Warwick University, involved building models that were dynamic in nature, scale independent and easy to implement by practitioners.

What was available in the literature at the time was the work of Jeff Harrison whom I was lucky enough to find at Warwick University (Harrison and Stevens, 1976). Their work under the name of Dynamic Linear Models (DLM) is described as:

Observation Equation

$$Y_t = F\theta_t + \epsilon_t, \quad \epsilon_t \sim N[0; V]$$

System Equation

$$\theta_t = G\theta_{t-1} + \omega_t, \quad \omega_t \sim N[0; W]$$

Prior Information

$$\theta_0 \mid D_0 \sim N[m_0; C_0]$$

Where

F and G are design and transition matrices;

V and W are subjectively determined covariance matrices and

ϵ_t and ω_t are serially uncorrelated random deviation vectors.

This work was presented at a major Royal Statistical Society meeting and it was widely recognized as the first and the beginning of a new direction in statistics termed as Bayesian Modelling and Forecasting.

This major contribution to science remained much within the academic arena simply because of practitioners' lack of appeal for it in ways of designing and setting initial values especially the state covariance matrix, W in addition to other technical problems involving over parameterization and scale dependence.

To address this issue, my passion for simplicity took me back to the basic principles that the model has been based on.

Considering a simple random walk:

$$Y_t = \theta_t + \epsilon_t, \quad \epsilon_t \sim N[0; V]$$

$$\theta_t = \theta_{t-1} + \omega_t, \quad \omega_t \sim N[0; W]$$

Given the initial state distribution as $\theta_0 \mid D_0 \sim N[m_0; C_0]$,

It can be shown that the state posterior distribution at time $t-1$, will be $\theta_{t-1} \mid D_{t-1} \sim N[m_{t-1}; C_{t-1}]$,

With $D_{t-1} = \{y_{t-1}, y_{t-2}, \dots, D_0\}$.

This gives the state prior distribution at time t , as $\theta_t \mid D_{t-1} \sim N[m_{t-1}; C_{t-1} + W]$

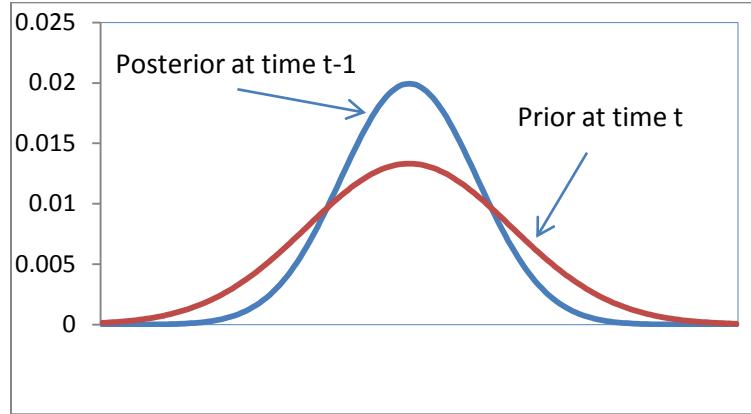


Figure 5 Posterior to Prior adjustments

The role of the additive deviation random variable ω_t is clearly seen to be the increase in uncertainty due to the time lag to express the degree of suitability in using information related to time $t-1$ for time t . Once the expression of relating quality of information to its age is realized, intuition and practical experience can come to action to widen the opportunities. For example, if we decide that the previous period of time's information would likely lose 5% of its quality, an alternative representation of the state prior distribution would be $\theta_t \mid D_{t-1} \sim N[m_{t-1}; \frac{1}{0.95} C_{t-1}]$ or in general, if the rate of loss of information was expressed as $1 - \beta$ where $0 < \beta < 1$, the expression will be $\theta_t \mid D_{t-1} \sim N[m_{t-1}; \frac{1}{\beta} C_{t-1}]$.

A simple comparison between the two variances can show that for a value of $\beta = \frac{c_{t-1}}{c_{t-1} + w}$, the two approaches of additive and multiplicative state random variability will coincide.

This gave the key to readdress Dynamic Modelling structurally and free it from the drawbacks of lack of practitioners' intuition in model building, over parameterization and scale dependence.

This idea led to the introduction of the principle of discounting information as a result of time lags.

The produced research papers received a very high profile when first presented at one of the general meetings of the Royal Statistical Society and it was considered to be a major breakthrough in statistical modelling and forecasting and became central in readdressing the entire statistical modelling process. As a side result in one of my publications (Ameen & Harrison 1984), I showed the classical Box-Jenkins approach to time series modelling as a limiting case of my newly developed models.

$$\lim_{t \rightarrow \infty} \left[\prod_{i=1}^n (1 - \lambda_i B) y_t - \prod_{i=1}^n (1 - \rho_i B) e_t \right] = 0$$

In addition to a successful PhD, the work generated a good number of publications, books and software packages by me, my research supervisor, my research students and other academics both in theory and in a wide range of applications in different fields. During an international conference presentation, Professor Adrian Smith, the then secretary of the Royal Statistical Society commented on my models saying that the presented models were a very promising breakthrough in forecasting.

Outcomes

Personal:

1. Five refereed journal publications as sole author and in collaboration with others;
2. Three exclusive (to Unilever Research) software packages;
3. Two research grant funds;
4. One successful PhD completion;
5. Citations of more than twenty by different prominent researchers across the world;
6. One external consultancy;
7. Six conference presentations;
8. My works have been cited by eminent international statisticians in excess of 50 articles.

Others:

1. One book on theoretical aspects of the models;
2. One book on multi-process modelling and monitoring of markets;
3. One commercial software: Bayesian Analysis of Time Series (BATS);
4. Numerous publications in different fields.

My contributions in this area, and in collaboration with others, generated a considerable amount of commercial and academic interest and my publications were cited by over twenty distinguished and internationally recognised scientists like Professor AFM Smith (the former president of the Royal Statistical Society and his PhD supervisor, Professor Denis Lindley; Professor Peter Young (formally at Lancaster); Professor M West of South Carolina and Professor Keith Ord (the co-author of *Kendall's Advanced Theory of Statistics*) from Pennsylvania State University.

Getting out of Hell

Only after nine months of my return to Kurdistan, Saddam Husain issued a decree that our university had to close and all academics had to engage in three months training before they are taken for live participation in the unjust war that was continuing with Iran. At that point, I decided to cross the border into Iran: the only way out of Iraq and ended up with my family in a refugee camp in the south of Iran.



Figure 6 Family photos from the Iranian refugee camp

The above pictures were taken secretly in our damp concrete blocked room in Jahroom in south west of Iran where I wrote to Warwick expressing my situation and intention of getting back to the UK.

It did not take long before the loudspeakers red out my name for a letter that I had from Warwick University stipulating their request for my services at their Department of Statistics and asking me to visit the Swedish Embassy in Tehran to apply for immigration visa. That call was my salvation from hell!

Back on Track

About a month after my return to Warwick, I presented a research paper in an International Conference on decision making that was held in Cambridge, UK and the Director of Research from Unilever approached me to work for them. After permission from Warwick and a daylong interview, I ended up working for them for about eight years as a scientist.

While at Unilever, I worked on introducing the idea of dynamic modelling into the area of market analysis.

These led to the establishment of original ideas in monitoring and control of market brands, price modelling and the analysis of promotional activities including two software products: DREAM (Dynamic Evolution and Analysis of Markets) and BASP (Bayesian Analysis of Sales Promotions).

At the time, market modelling used to be dominated by the classical approach which meant that the brands' sensitivity to market movements was expressed through single numbers as generic features of these brands. For example, price elasticity of a brand was described by a single figure and that was used by brand managers and decision makers to control brand sales. Brand managers used to produce lists of these figures and present them to sales managers in different countries worldwide while under the new approach that I introduced, brands' response to market changes is a dynamic feature and are likely to change as these market activities change and as a result, instead of a single price elasticity for a specific brand, there should be a price elasticity profile throughout the entire period of time that relevant datasets have been analysed.

To avoid conflict with the traditional advice that was given on a continuous basis by brand managers, I concentrated on a major brand owned by a competitor company to show the powers and the advantages of such an approach.

This brand (washing Powder) which is currently available in our supermarkets had been subjected to a major re-launch after introducing a major technological development. The re-launch had been followed by a large price increase backed up by a near linear increase in advertising expenditure for over three years. This clearly had moved the brand from the group of price sensitive brands to become price insensitive.

My models clearly showed this striking feature without the need for breaking the data history into two for pre and post re-launch as shown in the graph below:

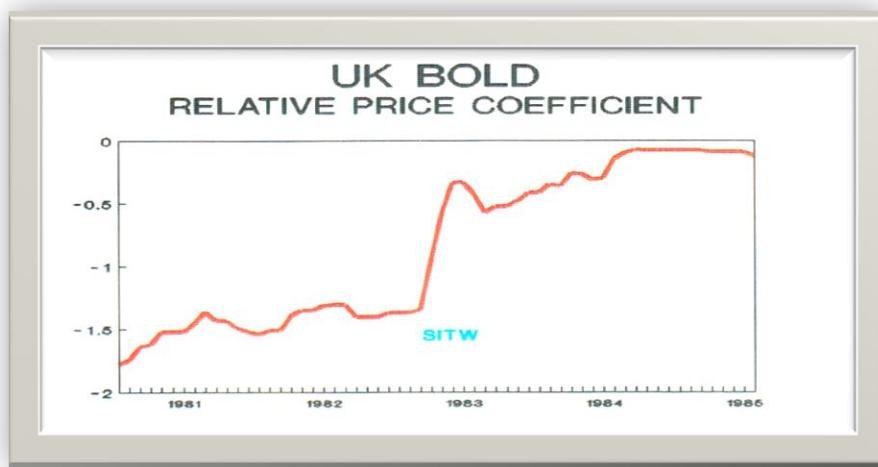


Figure 7 UK Bold Relative Price coefficients

What was more striking was the brands' sensitivity to advertising which clearly indicated a large initial increase in response to the re-launch and the technological innovation but gradually lost impact after a period of eight to nine months while the company kept heavily spending on advertising in the belief that it has an impact on the high sales (see figure).

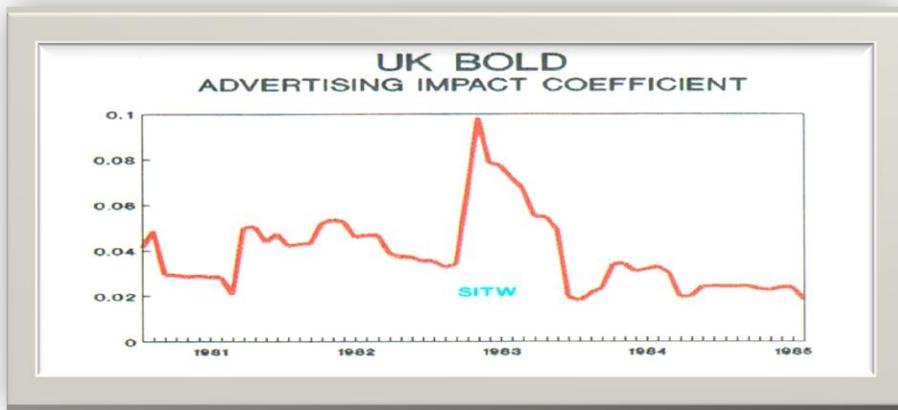


Figure 8 UK Bold advertising impact coefficients

This finding formed a masterpiece and all brand managers proudly took these figures and showed them worldwide within Unilever companies.

This work spanned over all Unilever brands worldwide and I designed and built a software package named DREAM (Dynamic Response and Analysis of Markets) and together with another model called BASP

(Bayesian Analysis of Sales Promotions) they were built into the company's toolbox through an external software company. The latter, when presented to the high committee, it was addressed to be "A solution for the problem that has remained on the shelf for a long time".

The part of my working life in that company was a golden age as far as contact with data and information is concerned. I had the opportunity to listen to managers with different backgrounds and different views and communicate my scientific findings as solutions to their problems in a language that they appreciated. These were practical factors that were missing in my academic career but the more time I was spending, the more I was seeing myself behind the academic arena and publications of transparent nature as companies rightly tend to work on keeping their competitive advantage inwards.

My work at Unilever was a turning point for me in switching my concentration from a single academic topic to a broader range of real life applications and made "Science for Society" a banner in my head. I suppose that is why industrial experience is so meaningful and important in someone's career but this was not without a penalty! This multidisciplinary approach to research, I believe, to a degree drove me away from the current norms of academic career development and caused a delay in my promotion to professorship but I am not regretting it in any way. That experience turned me from a scientist with a special and narrow field of interest in to a Multi-Disciplinary thinker. In addition to my experience at Unilever, I believe that my multi-cultural, multi-national as well as my scientific background in statistics and statistical modelling all played a big role in this.

In that respect, I can categorise my scientific net and achievements in two main groups of internal and external academic activities.

Internal Academic Activities

Like many other fields of science, over the years, the fast growth of technology has made most of the advances in modelling redundant. In this, models that were built to handle data that have been collected at annual, monthly, weekly or even daily frequencies are not suitable to handle today's highly disaggregated data using the more and more sophisticated data collection tools in health, engineering, environment and many other interesting fields. This has created a gap between statistical and computer science researchers both aiming to extract information from such data. In an attempt to close this gap, I have introduced the idea of zooming in and out of data just as the word means as people zoom in and out of pictures. This simple, yet powerful technique allows data analysts to access all relevant classical tools of data mining to identify subsequence discords.

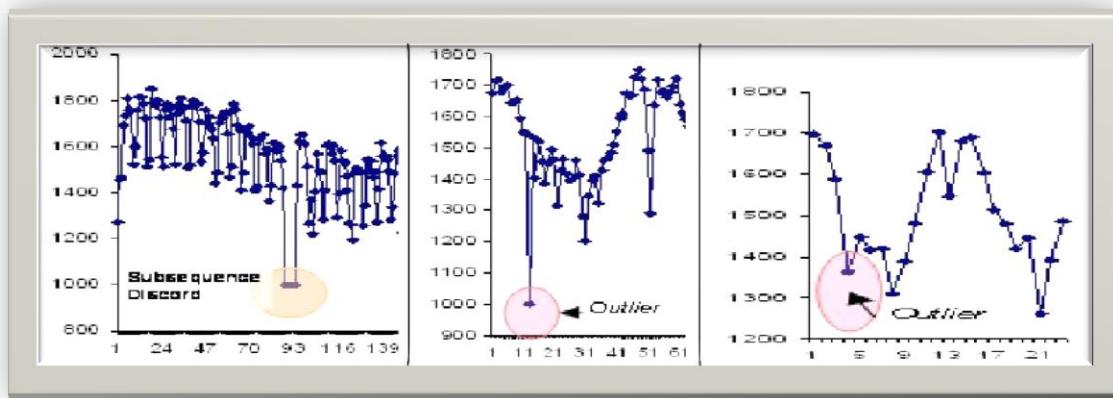


Figure 9 Data zooming process

In an attempt to initiate multi-disciplinary research, I also started broadening the department's contact with various departments and schools like The Business, Engineering and Health Care, promoting the importance of such modes of work and the role of statistics in this process. These initiatives were very productive and led to cross disciplines and cross department and schools research outputs.

The Business School

Working with the Business School led to the supervision of two PhD and two Masters Projects. One PhD was on the Malaysian Local Property Tax reform and one on Islamic Banking. Both students successfully completed their degree and returned back to their countries as ambassadors for Glamorgan. The two masters projects were on modelling and assessing intellectual capacity within companies and modelling co-integration between European Market Prices both completed with "Excellent" grades.

The School of Engineering

This collaboration led to the supervision of two PhD students and an external consultancy. One of the PhD projects was on modelling the causality of Qat consumption (a tropical evergreen plant whose leaves are used as a stimulant) on road fatalities. In this work, we stepped beyond the boundaries of statistical significance in an abstract sense to correlate car accident mortalities in Yemen as an influence of Qat consumption to influencing variables that would be controllable. The external examiner's report on the viva examination was expressed in a single word "Excellent!" and one of the referees of a journal paper commented on its content being a "Jewel in the crown!".

The other PhD project was on a European grant and after over two years of work, Professor Ron Wiltshire and I were delegated to rescue. In this, my Unilever experience in extracting information from data came

into action and I could predict a cusp catastrophe in Blood combination flow in the leg of Ulcer patients as a result of constant pressure increases using pressure bandages. Despite oppositions from the French clinical supervisor, the student managed to show analytically what was foreseen and the student completed her PhD in record time.

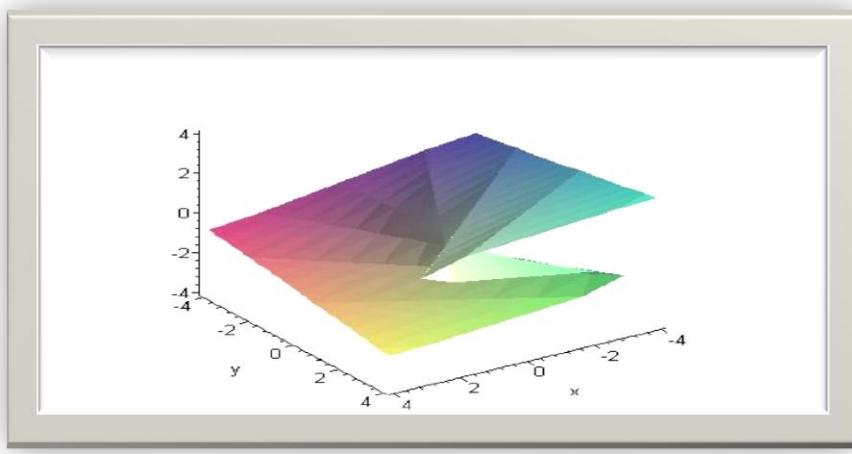


Figure 10 Pressure bandage data driven cusp catastrophe

A plane cutting the cusp in the graph above can represent a single patient profile from which decision makers can adjust the necessary treatment to avoid a sudden drop in the level of Oxygen (or a sudden increase in the level of Carbone Dioxide) in the patient's blood in the aim of speeding up recovery from leg and pressure ulcers (Fromy 1997; Unpublished PhD Thesis).

In another work within the Faculty of Advanced Technology, we managed to introduce effective geo-clustering techniques which were significant in identifying and modelling hot crime-spots in a city.

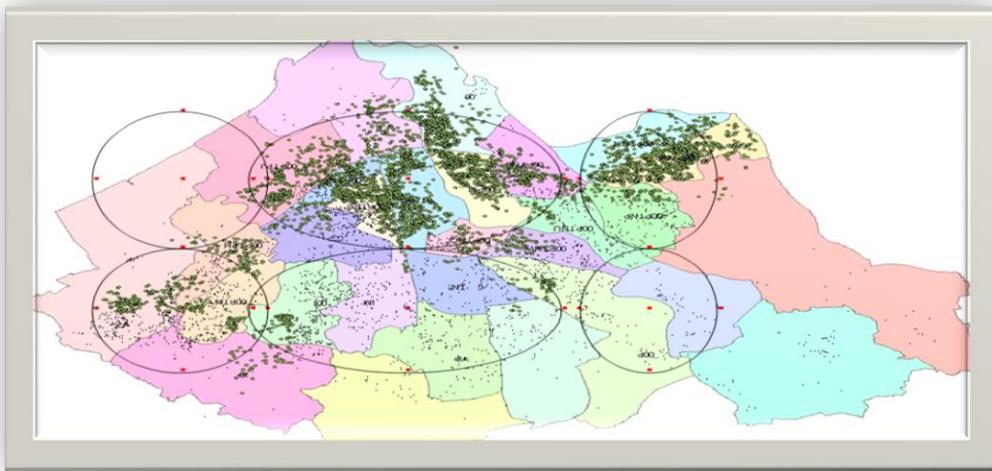


Figure 11 Geo-referenced crime clusters in a city

The developed methodology, although applied to modelling geo-referenced crime, it is generic and applicable in many life problems.

The School of Care Sciences

My collaboration with the School of Care Sciences extended to full time engagement for a longer period of time with many positive outcomes. In total, it led to six successful PhD completions and two successful MSc projects in addition to the refereed publication of collaborative works with about ten of their academic staff including a prototype hand held digital device that could be used by a staff nurse to monitor and assess pain and the state of leg ulcers in patients' homes. The latter had support by a "Proof of Concept" grant from the Welsh Assembly.



Figure 12 THAS Prototype

This device was named as "Techno Health Assessment Services (THAS)" and still awaits marketing. It was born out of two of the successful PhDs on the topic.

On modelling pain after day surgery, based on scientific reasoning, we identified the Visual Analogue Scale as the best tool for pain assessment and established that different operation types follow different pain profiles helping to design different more economical follow up plans with an improved patient satisfaction while modelling the state of leg ulcer based on colour, area and patient demographics led to predictive recovery profiles and opened the way for telemedicine to play its role in the use of designated expertise in the recovery process.

External Academic Activities

Following the same multidisciplinary strategy, our net was expanded beyond the boundaries of Glamorgan to include South Wales Electricity (SWALEC) and a local construction company.

South Wales Electricity (SWALEC)

Work with this company concentrated on modelling domestic electricity supply and demand in relation to various influencing variables like temperature, wind speed and humidity with data being made available at half-hourly level. Initial forecast models were so successful that the company expressed readiness to extend the contact and provided financial support for a PhD candidate to work on the problem. This went ahead and the candidate successfully completed his degree and he was appointed as Senior Lecturer within our department.

Despite the challenges in modelling time series data at such a detailed frequency level, we re-visited the classical and commonly used transfer function modelling of Box-Jenkins (1970) and introduced a new modelling approach based on variability decomposition.

In simple terms, if the intention is to model a control variable x_t in relation to a variable y_t through their variability, it would be logical to correlate the non-inherent variability between the two variables to obtain best control. By decomposing variability within each of the variables to its inherent and external components and then modelling the correct external variability, a significant improvement on Box-Jenkins modelling performance was obtained.

Rearranging

$$\delta(B)y_t = \theta(B)e_t$$

So that

$$y_t = \delta^*(B)y_t + \theta(B)e_t$$

$$y_t = y_t - \delta(B)y_t + \theta(B)e_t$$

$$\underbrace{y_t}_{H_t} = \underbrace{\delta^*(B)y_{t-1}}_{H_{t-1}} + \underbrace{\theta(B)e_t}_{E_t}.$$

Through this simple and straightforward reconstruction, it can be seen that:

$$Var(H_t) = Var(H_{t-1}) + Var(E_t).$$

This helped a revisit to the entire works of Auto-regressive Moving Average Transfer Function models and their applications that have been in action and in almost all practical applications for over eighty years.

We also showed that the consideration of total variability in the modelling approach will often distort the resulting models.

The notion of Degree Days was used to model the complexity of electricity usage in domestic homes as it relates to many variables of temperature, humidity, wind speed, cloud cover and other variables that are often difficult and uneconomical to obtain. Degree Days is defined to be the amount of heat required to maintain a building at a given temperature. The following chart represents average degree days by units of electricity consumed for the four seasons of a typical year in South Wales:

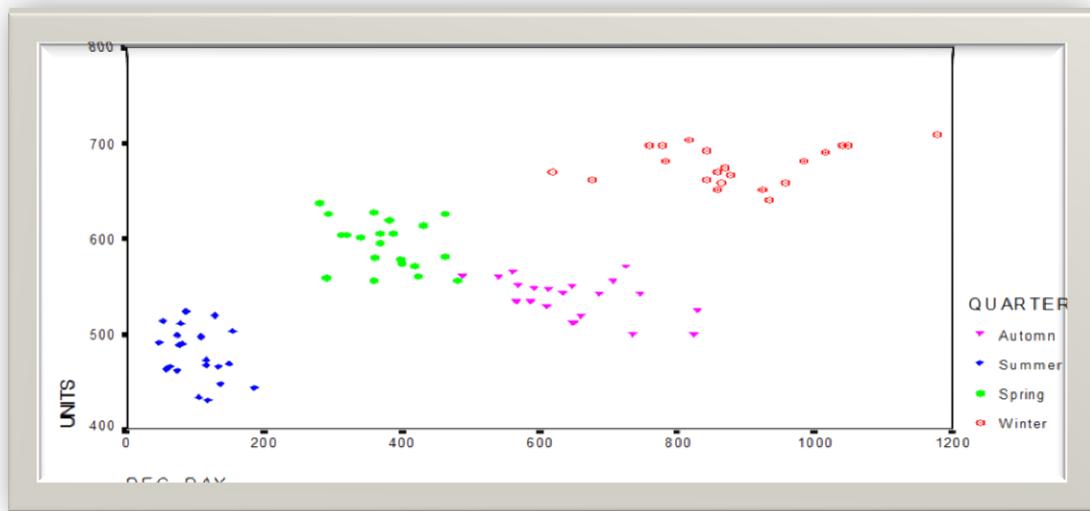


Figure 13 Quarterly Degree Days by units of domestic electricity consumed

The open bird-wings shape for the winter figures created a challenge that I could not answer!

Model forecasts showed remarkable superiority to other models performances as shown in the graph below.

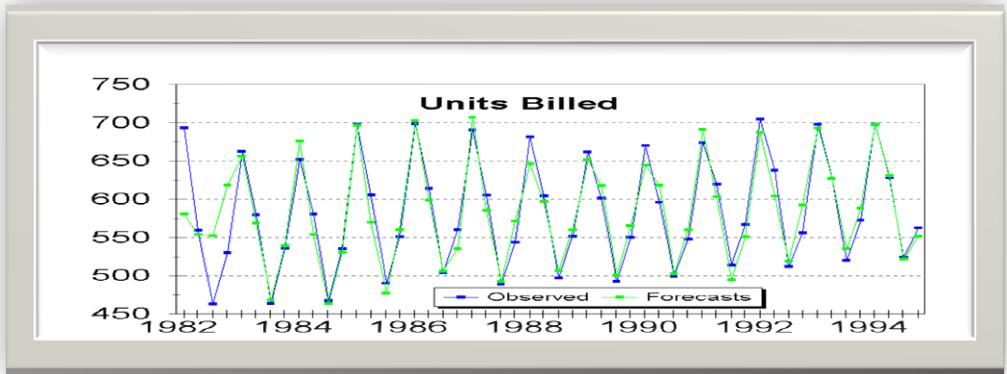


Figure 14 Model predictive performance

Kelston Sparks Contractors Ltd

This was a subcontract valued at £3.4 million pounds on the Ilminster Bypass in Somerset.

With my co-worker at Glamorgan, we were asked to provide scientific support to a claim for damages from the main contractor due to their request for work beyond the terms of their contract.

Going back to the recorded cases with some detailed information, I modeled time use for different task completions under often harsh conditions as in the graph below.



Figure 15 Work conditions at site

A ‘time’ predictive model was built based on various weather conditions, equipment used and size of task to be accomplished. The developed predictive model (Figure 16) has the potential to be used for engineering time and cost estimation.

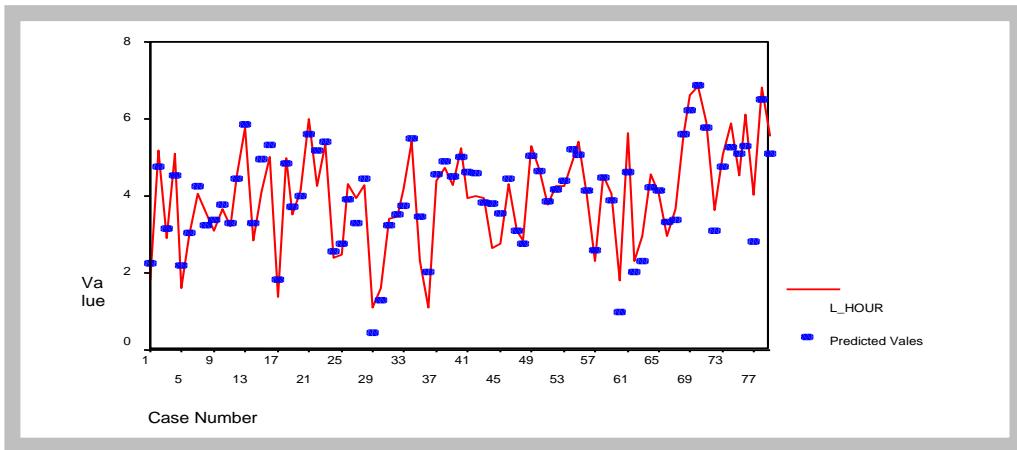


Figure 16 Model predictive performances

The developed model was then used to estimate the time and hence extra costs occurred due to misjudgments and forced works under harsh conditions. We defended the model and its outcomes in a tribunal in London and our client won the case.

Work at an International Level

The events that forced me to leave my home and relatives behind and migrate to the United Kingdom were later intensified to include chemical bombardment of many Kurdish villages, bulldozing most of them and even cementing natural springs in an attempt to eradicate life in the area as well as the Anfal (code named by Saddam with the name taken from a versus in Qur'an on spoils of war and cutting the roots of unbelievers) campaign. As the western media intensified its efforts in raising the world's public awareness on Saddam's inhumane actions against the Kurds as well as his army's invasion of Kuwait, the civilized society could not stand idle. A safe haven was declared for the mostly populated Kurdish land in the north east of Iraq and the liberation of Iraq began.

The window of pictures below contains just a few snapshots showing the history of brutality of the Saddam regime on the recovered corpses of Barzani men from mass graves in the south of Iraq, the concentration camps of Kurdish children, elderly and women similar to those of Adolf Hitler, the Halabja chemical bombardment results and the late large exodus of the entire Kurdish population as a result of their terrorization by Saddam forces after being crushed by the Allied forces and driven out of Kuwait.



Figure 17 Unpleasant scenes from Kurdistan during Saddam's era

After the formation of a self-ruled administration in the Kurdistan Region and as a personal obligation, I proposed the establishment of a system for the region to be called “Data and Information Centre for Kurdistan” to be a platform in which data and information on Kurdish society are easily available to researchers in academia to work on extracting socio-economic policies for Kurdish decision makers as well as the private sector to help rebuild what has been ruined for the past decades to ensure that future generations will not seek refuge in other parts of the world.



Figure 18 Demonstrating slide

A presentation was made to HE the Prime Minister of Kurdistan Region and HE the Minister of Planning as well as to a large academic audience in Erbil, the Capital of Kurdistan Region, and the proposal gained the support from all sides.

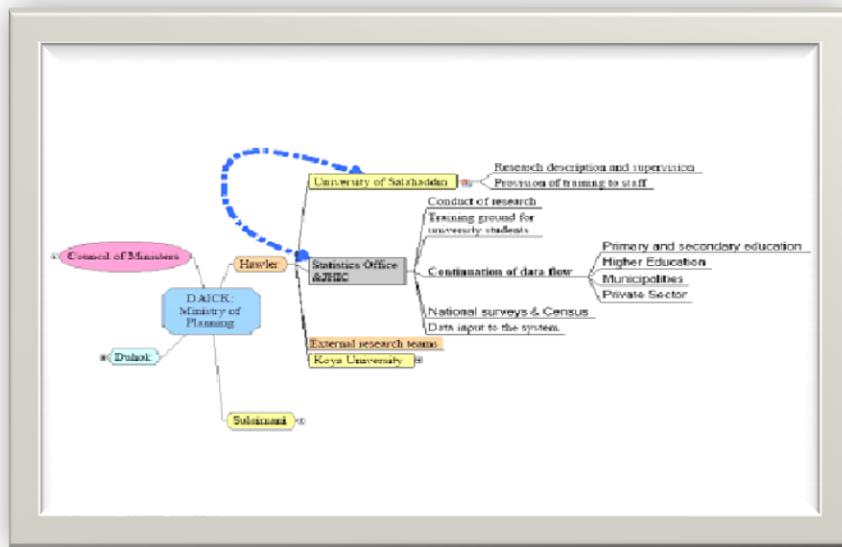


Figure 19 The structure for Data and Information Centre in Kurdistan

Work soon started on the project and a database was created alongside several important surveys including:

- Iraqi Household Socio Economic Survey with the World Bank;
- Multiple Indicators Cluster Survey with Unicef;
- Food Security survey with the World Food Program;
- Iraqi Family Mental and Health Surveys with the World Health Organisation.

In addition, several other surveys were conducted on unemployment, agriculture, industry, health and the environment. All the summary reports and indicators were made available for the public from the regional statistics office and a lobby was made within the Kurdish academia to make use of them and propose research projects adding value to what were already available.

Results from the Iraqi Household Socio Economic Survey were exploited by a national team of which I headed the representation for Kurdistan Region, to estimate a national poverty line and drew a national five year poverty reduction strategy that covered poverty in health, education, economy and the social dimensions of gender and safety nets. The strategy was approved by the Federal House of Representatives from whom I was awarded a gold medal from the House of Representatives and a trophy from the World Bank.

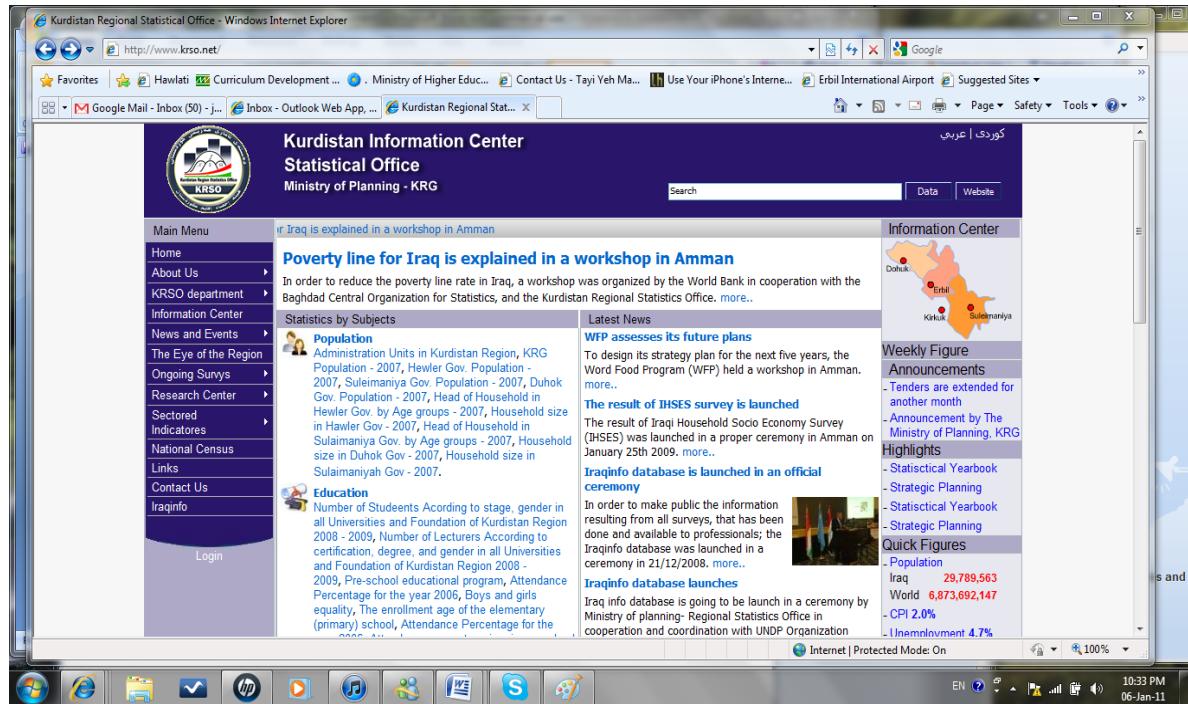


Figure 20 A view of the designed database

All the information could be geo-referenced as well in order to observe geo disparities.

A number of striking features revealed from these works were firstly a picture of the whole of Iraq -with all human settlements geo-referenced on its map revealing a fundamental difference between the Kurdish and the Arab communities settlements over centuries that could distinctly separate the two communities. Relying on natural water sources, the first has built a large number of small villages and made their livings on farming while the other community has built much less settlements but larger in sizes and relied on village trade for their living. This fact formed the base in several of my political and social articles that received considerable interest when they appeared in the local press and they were referenced by the World Bank in their international report on poverty geo-diversities in the Middle East and Northern African (MENA) countries.

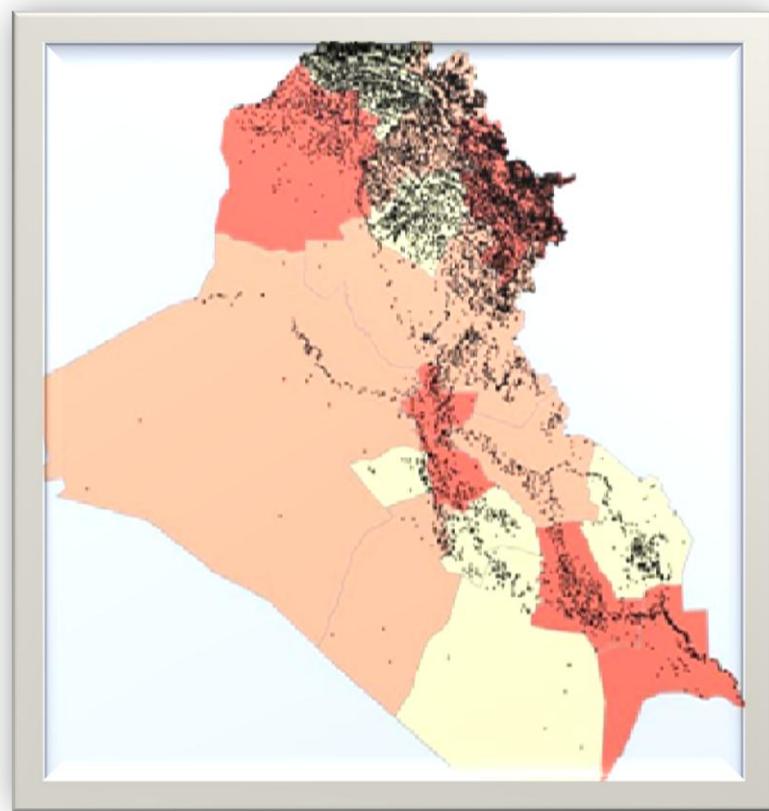


Figure 21 Map of Iraq with all settlements

The second most significant result was the population pyramid of Kurdistan Region that had clearly mirrored the war crimes of Saddam on the population when compared to its counterpart in a developed country like the United Kingdom.

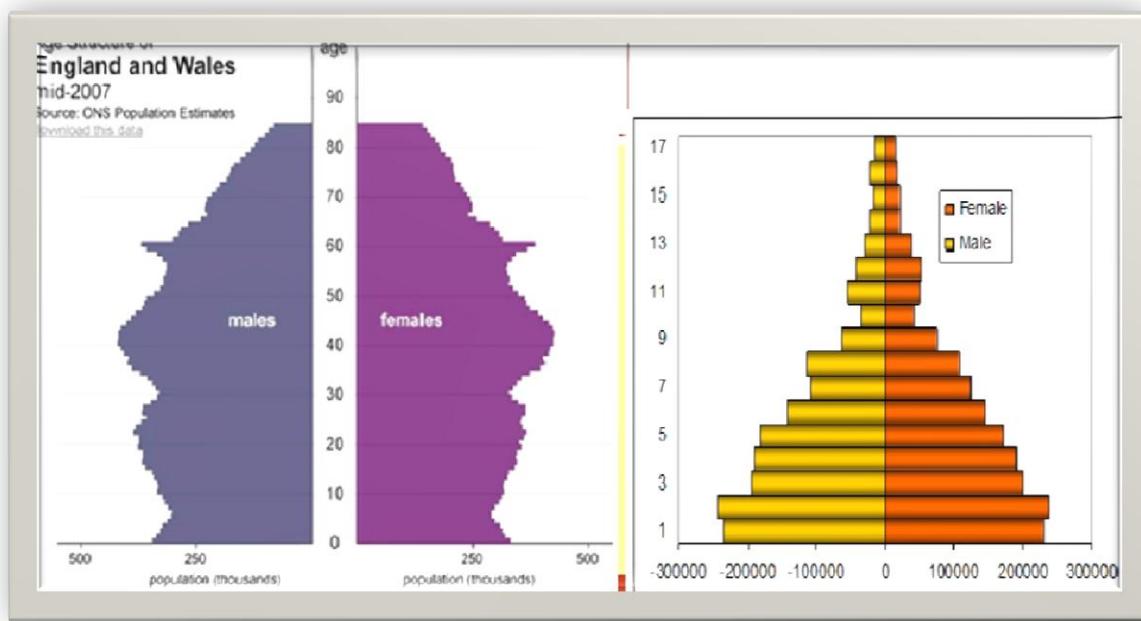


Figure 22 Population pyramids of the UK and Kurdistan Region

This striking comparison gave me the idea to revisit the commonly known Leslie Matrix for population estimates and use it to get an estimate for the **Human Cost of Tyranny in Kurdistan Region** based on current population estimates, population figures from the 1947 and 1957 national censuses as well as population growth rates, population fertility rates and survival probabilities.

Projecting expected population figures had life been normal in Kurdistan on the current population pyramid resulted in a loss of a total of 1,911,479 people of whom 1,043,549 turned out to be male and the remaining 867,930 female.

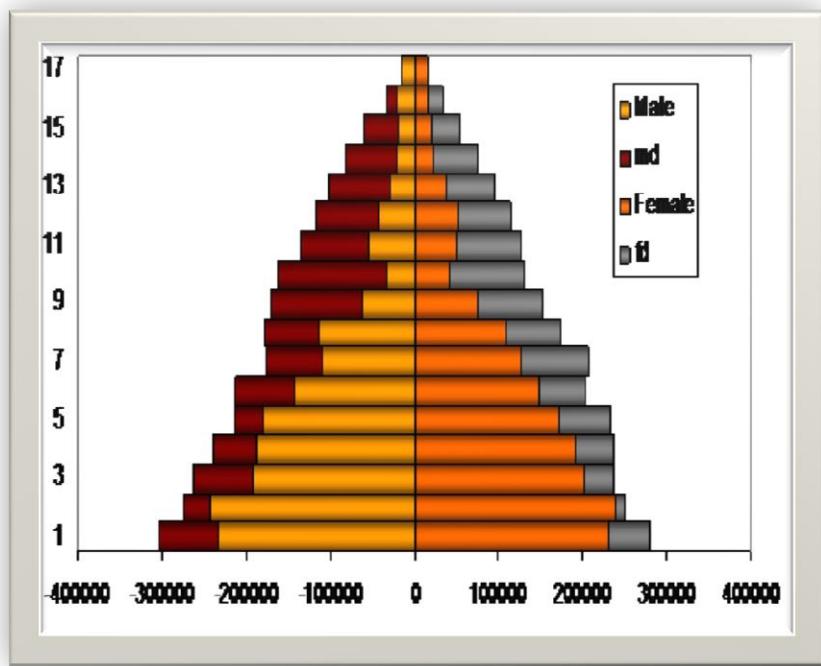


Figure 23 Observed and predicted population pyramids of Kurdistan Region

Concluding Remarks

The journey of life is fascinating. It would obviously be an impossible wish to want it to be repeated and if ever that would be possible, one would use all the experiences gained to do far better to improve life on our planet. However, the second best wish on this basis would be the will and the ability to pass all these experiences to our new generation to carry the flag and even better, to create capacity and encourage independent thinkers and that is what I am obliged to do as I have learned from my teachers, scholars and colleagues. This is what makes the job of academics so sacred and it is with pride that I have to thank all those whom I learned from on my life journey. I have learned enormously from my co-workers, students and colleagues. Not implying that I welcome it back, but I learned from the inhumane Saddam's policies and his implementing Junta to be resilient, forgiving but not forgetting and learned from my refugee camp supervisors to be a strong survivor and in all I learned that there is no failure in life as much as it is a learning process.

I conclude by our university's banner saying: ***You live, You learn*** as a cornerstone of life and its Bayesian dynamic quantification.

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