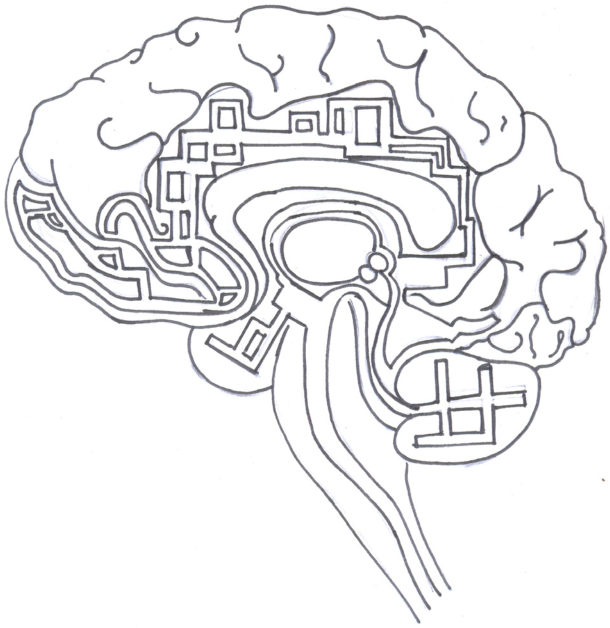
Chapter 8
Mind Mapping



Always preoccupied with his profound researches, the great Newton showed in the ordinary-affairs of life an absence of mind which has become proverbial. It is related that one day, wishing to find the number of seconds necessary for the boiling of an egg, he perceived, after waiting a minute, that he held the egg in his hand, and had placed his seconds watch (an instrument of great value on account of its mathematical precision) to boil! This absence of mind reminds one of the mathematician Ampere, who one day, as he was going to his course of lectures, noticed a little pebble on the road; he picked it up, and examined with admiration the mottled veins. All at once the lecture which he ought to be attending to returned to his mind; he drew out his watch; perceiving that the hour approached, he hastily doubled his pace, carefully placed the pebble in his pocket, and threw his watch over the parapet of the Pont des Arts.

Camille Flammarion

Popular Astronomy: a General Description of the Heavens (1884), translated by J. Ellard Gore, (1907), 93.

Mind mapping? The word conjures a series of both remote exotic structures and unknown complexities. Imagine your mother screaming at you to get your room clean, your phone ringing, your friends sending you messages on the various social networks, music and TV competing for attention… while you are trying to study. Your mind starts to spin…you need to organize yourself and your thoughts before you start into something that is logical… that is what mind mapping is all about…Mind mapping is a tool to clarify one's mind and help visually draft the process from concept to tangible measuring as described in Chapter 5.

What is a model?

Prior to defining a model, it is best to introduce the issue that mind mapping requires a *sea change* (a veritable transformation) in how researchers visualize information. Thoughts can be listed in a column of data quite easily, however for mind mapping models, one requires an understanding of different dimensions and perspectives as the model allows for an analysis of a phenomenon which can take up both cross-sectional (through space) and longitudinal studies (over time). It allows for the transformation of data into such dimensional structures as 3D. It also allows for dynamics that cannot be replicated in other models since the cell-based variables can be moved within the virtual world and relationship can be better understood through visual effects.

By definition, a model is a representation of a structure which has within it the requirements which allow for the investigation of that same structure. By structure, one can include theories, hypotheses and data. Within a model one can include relationships and statistical elements. Models can also be used to predict future occurrences and also to investigate past events.

A model allows the researcher to study the real world through a series of observational activities. A design of the model is based on the information structured from the observed data. This triggers ideas for further research. The model itself allows for a feedback loop from the ideas to the observed data, since most ideas call for new data requirements and adjustments to the data gathering process.

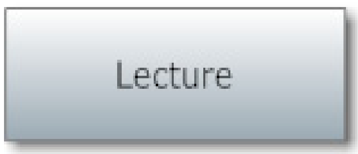
The mind map exercise elicits the need for the clarification of specific questions that require investigation before one initiates the modelling process. These questions are reviewed in the following section.

- **Can one translate human activities into a functional model?**

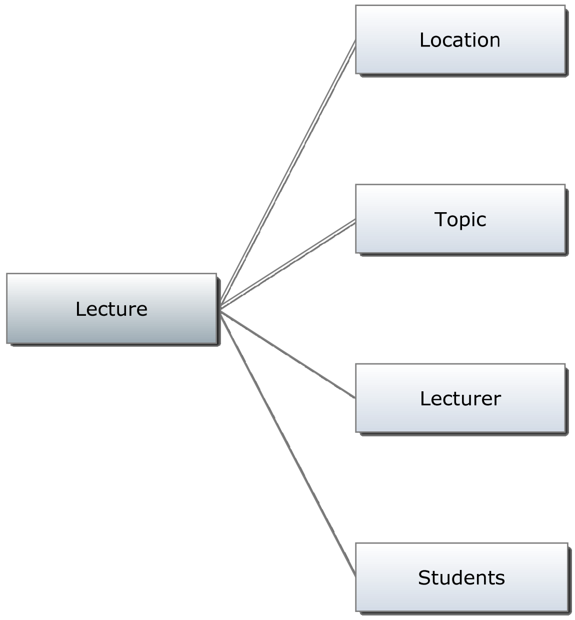
Whilst seemingly impossible to translate human activities onto a map due to the myriad interactions and the intrinsic phenomenology, one can initiate processes to try to understand such interactions or relationships through the component parts. Human activities can be broken down into smaller and smaller issues (that require investigation). Once an activity is disassembled into smaller relationships, these relationships can be identified and then the model can start taking shape.

This process (described here) works in the opposite way to mind mapping since it de-structures an issue into the component parts (since the construct is already known as against a mind map where one has to start from scratch). However, this process enables the reader to understand how human activities can be translated into a model.

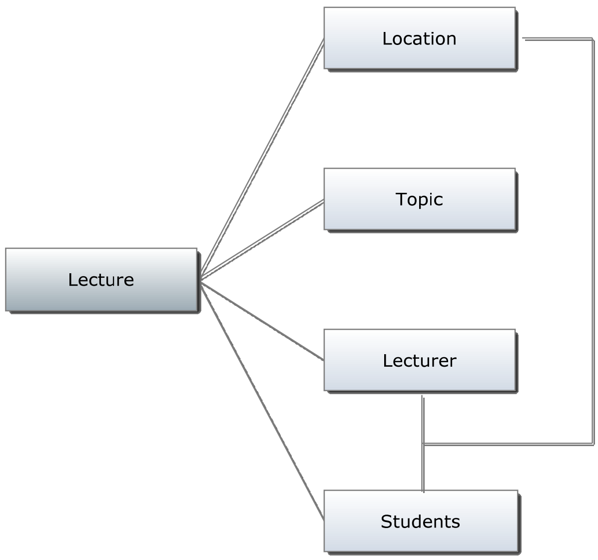
Let us take the example of a lecture held in a classroom:



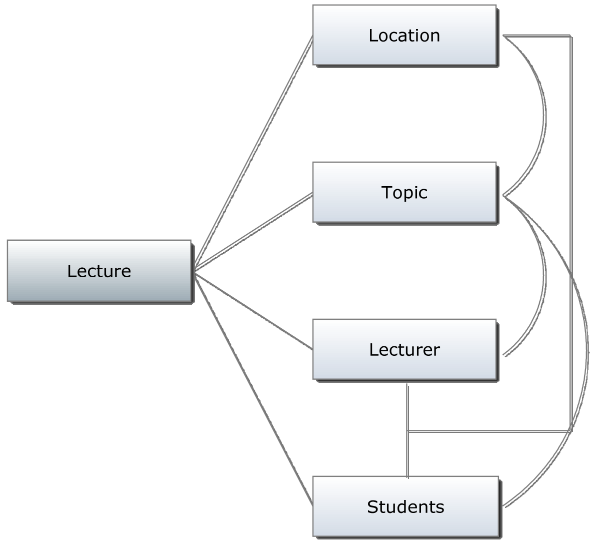
Disassemble the activity into its main components:



Identify the interactions occurring between the different components



There are evident interactions between the lecturer and the students and these occur in the location where the activity is held. Thus the particular interaction can only occur if both lecturer and students are located in the same space. Should the activity be held online, then location is superfluous to the exercise and can be eliminated from the study. In this case, the activity is not absolutely dependent on the topic under discussion, since the lecture is being held in a classroom. Should the topic have been one that necessitated a specific location (such as a dissecting lab), then the links between the entities would have been more diverse and would have included all four components.



Once all the possible relationships are mapped, then a model can be constructed. This model enables one to map human interactions. The move from concept to entitation to quantification and eventually to composition is possible, but only through a thorough understanding of the interactions at play.

- **Can one build a model / Does an application exist?**

One can build a model through the use of both analogue and digital technologies. Whilst the former is drafted on paper/cardboard, the digital version allows for full-range and very large model creation, one that can be given extra layers of data as are required in understanding the relationships. These include: the theoretical approaches, the datasets being investigated, the sources of data, the actual variable mapping and the linkages between the variables. In addition, one must also allow space for the insertion of future linkages and codes within the model.

Applications that help such model building include Smart Draw,[1] Mind mapper,[2] and Visual Mind,[3] amongst others. The model is based on imagery which establishes links between the different types of information, which links allow for the inclusion of images, lines, arrows, words and bubbles.

The important aspect of such a tool resides in the ability to expand on one's ideas and branch out into the different sub-topics emanating from that topic. The idea of splitting a topic into sub-topics and ever more sub-topics fits our purpose perfectly as it allows problems to be split up into their smallest components.

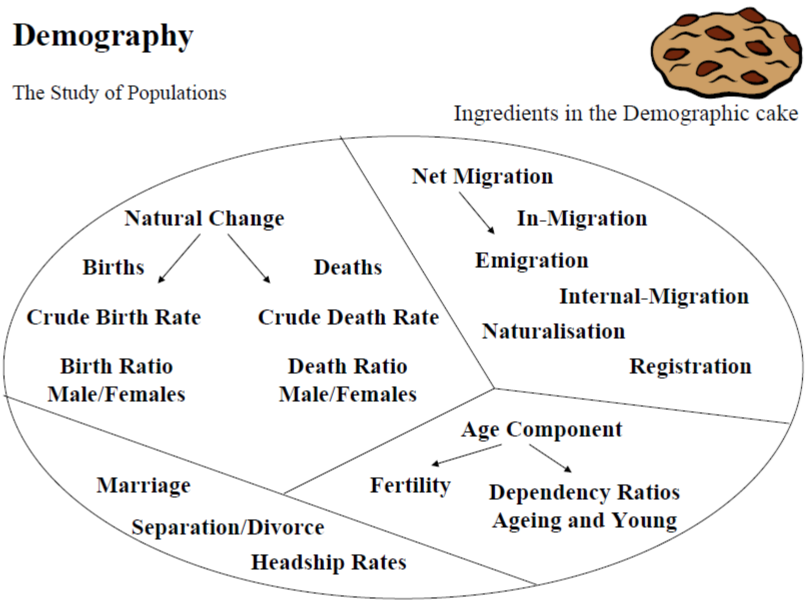
There is no need for a linear (straight-line, direct) link between the topic/subtopics. Links, can be expressed in a variety of ways across and within the levels. The case study example below gives an overview of how such a mind map is created.

Case Study: Creating a mind map for the Study of Population and its links to Housing

Step 1: Start with a rough drawing of what the elements of this mind map constitute (Figure 8.1).

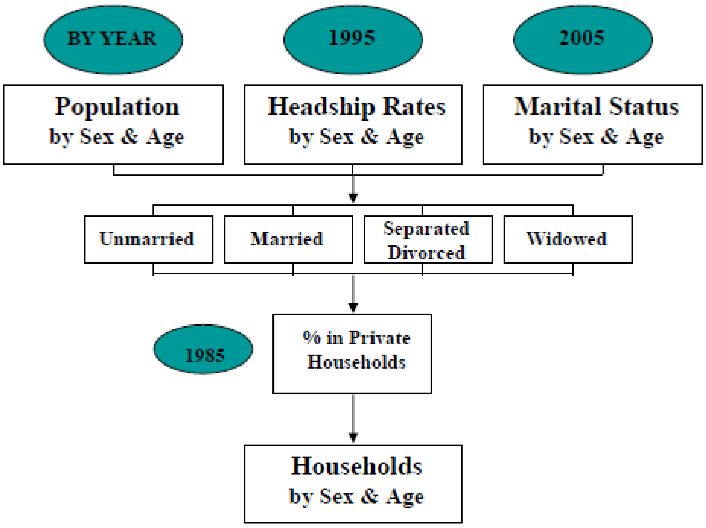
[1] http://www.smartdraw.com/
[2] http://www.mind mapper.com/
[3] http://www.visual-mind.com/

Figure 8.1: The Demographic Cake



There are four main elements that fall within two main themes: demographic structure and household structures (through headship rates). Whilst the image above defines the demographic structure, the figure below shows the steps taken to form an idea of the household structure. These eventually lead to an estimation of the need for housing based on the available infrastructure (Figure 8.2).

Figure 8.2: Households Structure



Step 2: Create the main theme (population)

Step 3: Identify the sub-topics (main tenets)

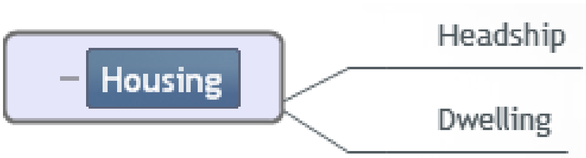
- Housing
- Demographic Structure

Step 4a: Identify the sub-topics for Demographic Structure

- Insert: Natural Growth and Net Migration

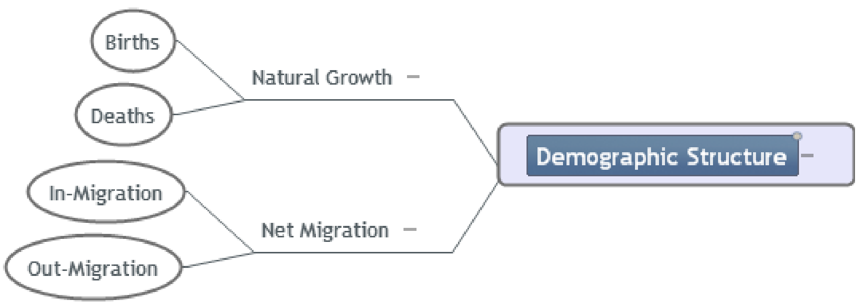
Step 4b: Identify the sub-topics for Housing

- Insert: Headship and Dwelling

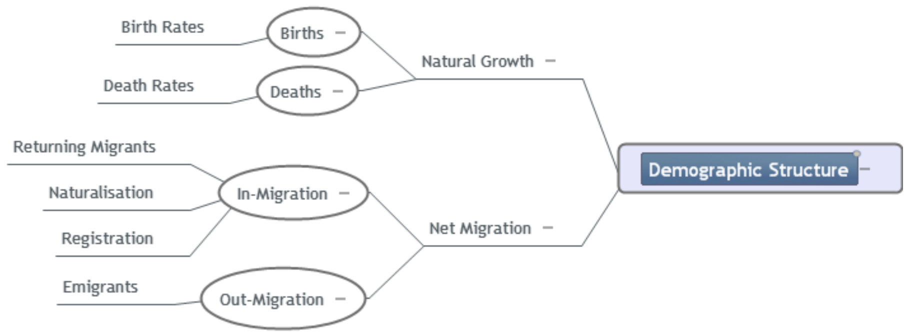


Step 5a: Identify the sub-sub-topics for each of the elements identified in Step 4a

- Insert: Natural Growth and Net Migration sub-elements

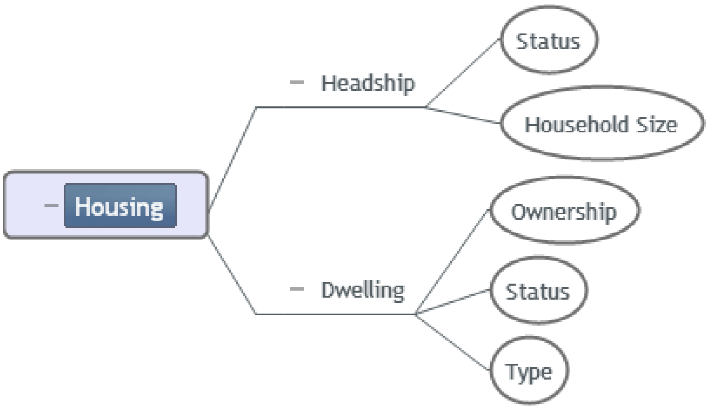


- Insert: the subsequent sub-elements

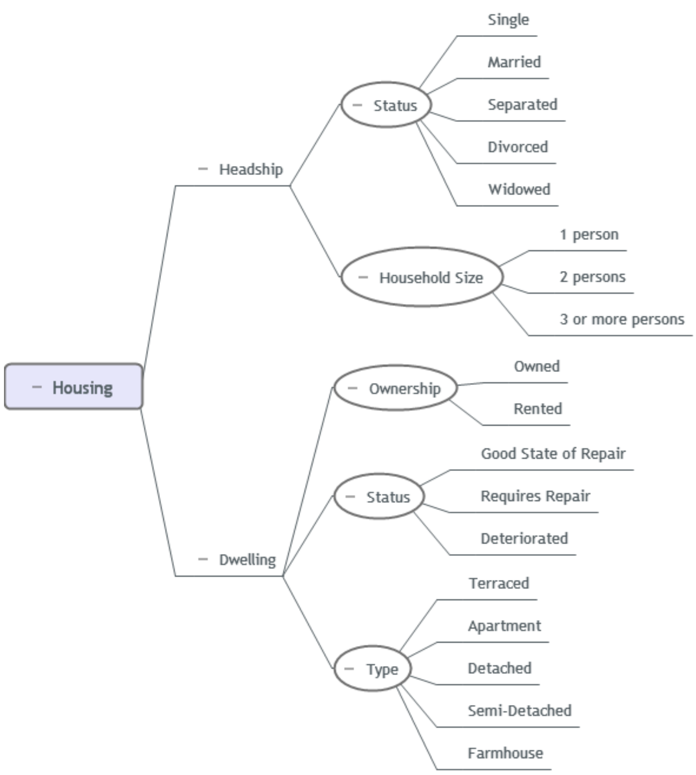


Step 5b: Identify the sub-sub-topics for each of the elements identified in Step 4b

- Insert: Headship and Dwelling Types sub-elements



- Insert: the subsequent sub-elements



Step 6: View the result in its entirety and start thinking about the links between the elements.

The final mind map that depicts all the elements is defined in Figure 8.3.

Step 7: Create the potential links between the different elements

The resultant basic mind map can allow one to acquire an idea of how the elements will interact. The result can then be taken to other levels through the inclusion of more informational issues that are described in the section below and in the CRISOLA example (Figure 8.4).

Figure 8.3: The Mind Map Elements

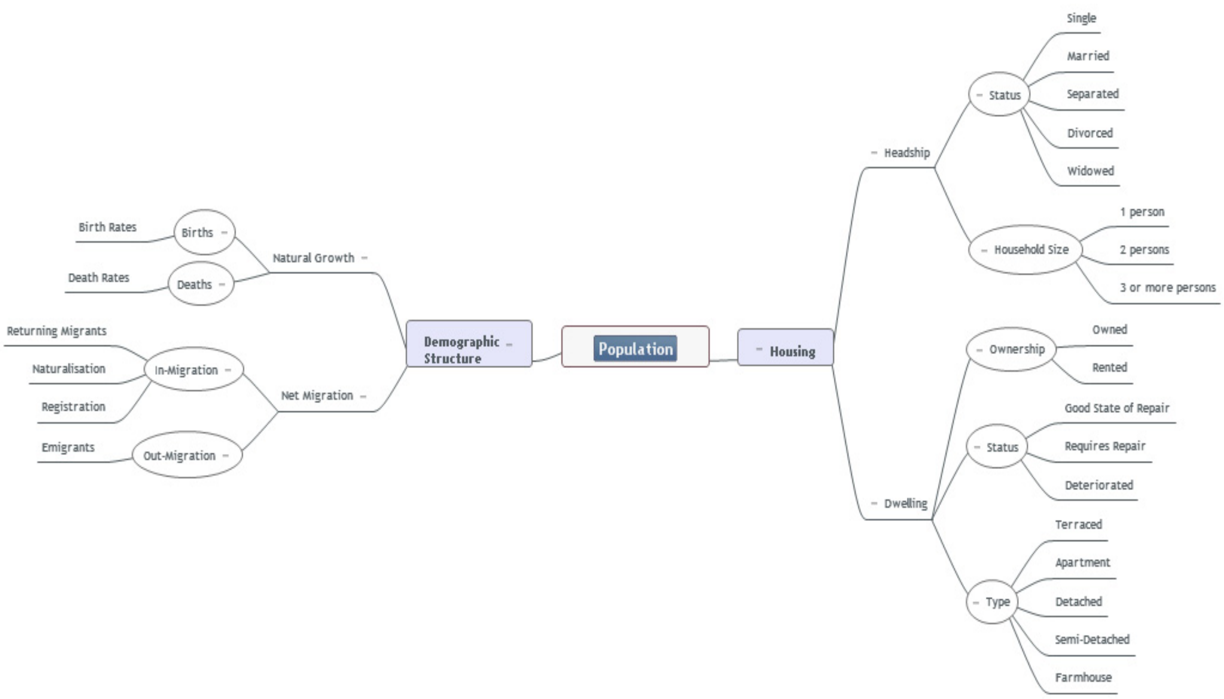
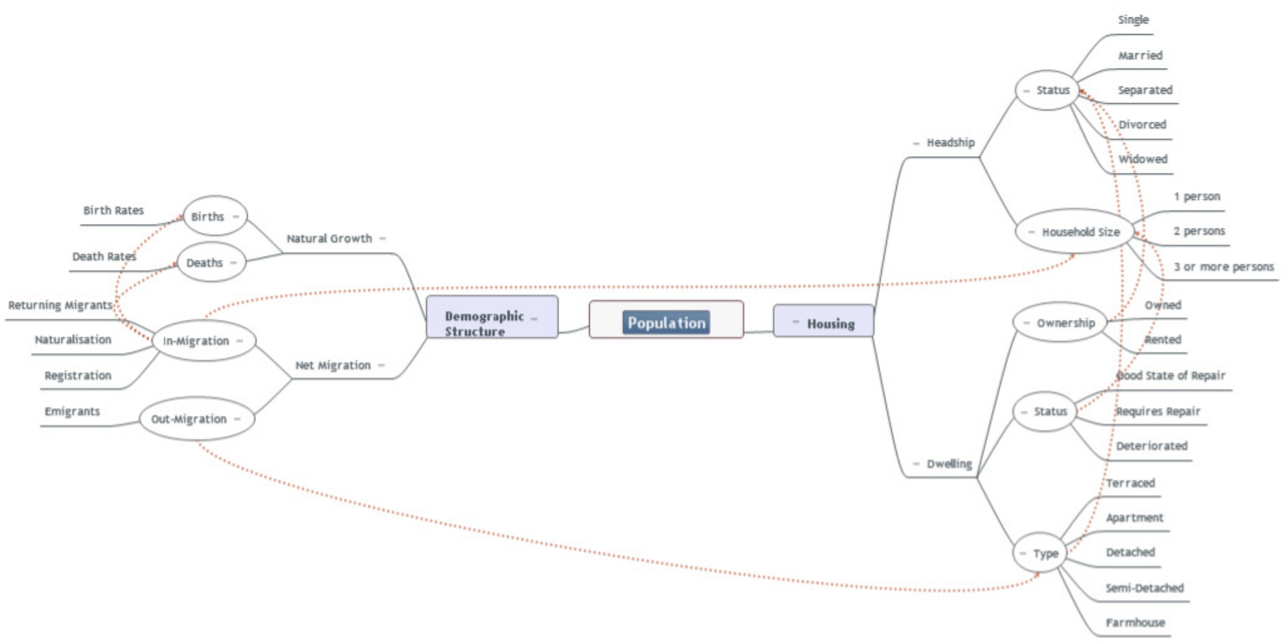


Figure 8.4: Linkages



Who are the players?

The players in a mind map are basically very few: they comprise the following:

a. the main topic
b. the sub-topics
c. the links between the topics
d. the dependencies (direction of dependency)
e. the data sets representing the topics
f. the data sources
g. the measurement scales

Each of these helps to enhance the model into an understandable structure. Although most mind maps only contain the first three items, the rest of the items are necessary to build a model.

- **What infrastructure is needed?**

Very little infrastructure is needed. A reliable computer and the relevant software should do. It is a good idea to prepare a parallel hardcopy version which would allow one to mess around on paper before drafting it digitally.

- **Can researchers afford to stay away from technology?**

A highly interesting question indeed! This book gives an idea of the efforts required in research generated in the social and natural domains. It emphasizes the use of technology, but one must not feel left out if the modus operandi lays preference to a manual approach. There are many ways to carry out research however, over the last few years, effort has centred on the use of technology as an aiding tool. One resultant problem is that faced by technophobic researchers, when they find themselves forced to use technology. However, another problem posed is that of a technology-side effort to always use technology, thereby imposing their wares into the social domains.

The socio-technic approach has proven successful since it has brought technology to the uninitiated – especially those in the social-domain. It has helped research to take off at phenomenal rates and has allowed for phenomenology to be analysed so intensely that we are currently investigating the links between the social sciences, the natural sciences and the physical sciences. Thus, today, it is possible to carry out research aimed at analysing the instance of an offence (criminological - social) occurring in a specific location (spatial - physical) that may have been triggered by a meteorological (atmospheric - natural) effect such as low atmospheric pressure combined with episodes of high pollen dispersion (biological - natural) and high noise levels (environmental - natural). Such links can only be tackled using high-end technology and one must be aware of the possibilities available for such research. This said, such a positive drive has to be counterbalanced by caution: technology must serve the user and not serve as a tool for abuse.

Conceptual Modeling

This above discussion has shown that there are different levels and activities required in creating a model. In effect, creating a model can only take shape through the understanding of the CONTEXT within which that activity occurs. There are various levels that can be described prior to creating a model moving from the outline identified in Chapter 5, from concept to tangibility.

The first step is thus to create a model based on the idea (concept), called a Conceptual Model. As shown in the Population and Housing example above, the different elements must have been sources from somewhere and must mean something to different persons and operations.

Why should one research population in relation to housing? Are researchers studying phenomena for phenomena's sake or are they linked with the operational sector. In order to start identifying the different levels, one must first understand the dynamics that such a model may fit in through a process spanning the visionary (idea) to the planning aspect to the operational and the eventual implementation.

Any model must fit the levels as based on the level of need. For example, a decision-maker does not need to know which house will be occupied by which family, but would require knowledge of how many dwellings are required for the next 20 years to ensure that the supply is there.

The following levels of need are required prior to understanding the type of model to be drafted. One can create the most detailed model and then switch off those levels not deemed necessary for the levels above that.

- Global vision perspective - Visionary:

The philosopher king sits here. The person with a vision is the person who will identify the need for some kind of change. One can identify that there is a need for housing but does not need to know what types as long as the units are available. Neither does a visionary need to identify what the population structure will look like but only the information that it will grow.

This refers to the highest level knowledge of the W6H but at a very abstract level. There IS a requirement to know where one is coming from and where one is going but not necessarily knowing how to implement such. The links between population and housing can be established at this level, but it is up to others to establish the links.

- Strategic Planner

This level requires knowledge of what will happen in the mid to long-term, often basing one's studies on a 10 year (for local or regional levels) and 20 year for strategic levels. The planner needs to be able to overview planning, taking in the ideas generated at the global perspective and moving them towards a more realistic approach. The planner must have knowledge of the on-the-ground levels and the higher level visionary levels.

At this level, one can include the policy maker and the decision maker who have to draft the actual policies and legislate on them. They would need to know the links between the demographic structures and the housing elements in order to effect their proposals for change. Thus, at this level, the model should also show the links between the different elements, though not necessarily those links at the most detailed levels.

- Operational Designer

This level instigates the need for a model that shows how one will implement the requirements of the strategic level. This level would need information on how to link the demographic projections based on different scenarios with the need for specific housing types.

An example would be to link a scenario that predicts an increase of the elderly population and their requirements for specialised housing such as community-based services, the need for smaller housing types, the areas where such dwellings can be situated and the marketing actions to convince elderly persons to move into smaller residences.

- Administrator

This level structure plans on how to operate the required changes on the ground. The model at this level should allow for detailed information on what is required to actuate such a change, in terms of: design, materials and administrative procedures. This is the nitty-gritty level and concerns who does what and when – within the constraints established by the levels above.

- Tactical Planner

At the end of the line one can find the tactical planner – that person who will be working in the field and who requires the deepest level of information to ensure that the job gets done. This level works on the specifics on what needs to be carried out and how best to ensure that it occurs.

The Three Dimensions ensconcing a conceptual model

At any level of research, a conceptual model has to keep in mind three important dimensions within which that model operates.
(Source: www.els.salford.ac.uk).

Models look at…

- the **spatial** dimension: where something is located
  - any policy or decision or research has to occur somewhere, whether it is in real or virtual space, whether in terrestrial, bathymetric or extra-terrestrial terms, whether in a flat digital domain or an integrative virtual digital domain
  - there is always a location to a model

- the **thematic** dimension: the characteristics of that something
  - the character of either the location or the object occupying that location
  - the topic, policy or strategy under study
  - the theme has to be defined by its component categories

- the **temporal** dimension: when something occurs
  - the comparison of data over time
  - why something occurs when it does
  - the span of the research
  - not restricted to the present but also the past and the future. The future can only be visualized at all the levels through a knowledge of the past with the present used as a starting ground for the study of the interim period between the past and the present and the present and the future
  - there is always a time factor, whether when the study occurs or when the activity under study occurs or will occur

Moving towards implementation of the Model

In order to move from a conceptual model to a working model, one must again move towards an unravelling of the complexities built into the reality being studied. Thus, the conceptual model's reincarnations are tools that will be used in a computer to replicate the real world process one is trying to model.

This process is based on the steps identified by Peuquet (1990) in his description of **Levels of Abstraction.** Peuquet's work on GIS can be translated to a mind map which drafts the process from reality to abstract user-oriented information structure to concrete machine-oriented storage structure of the computer. From the latter one can then run the necessary queries and implement to outputs from the model.

The modified Peuquet structure below takes the Peuquet model and transposes it for any data type.

There are 3 stages that need to be taken into account:

- Stage 1: identify those entities one is interested in and decide how to represent them;
- Stage 2: choose a data model that computers are able to display, analyse and store your entity representation;
- Stage 3: draft a "nuts and bolts" stage where one instructs the computer how to recreate the entities identified earlier.

Content Analysis

How does one use a mind map in non-quantifiable studies? Can a mind map be created for information extracted from textual material? Content analysis comes to the rescue.

Content analysis usually refers to the analysis of a written material. This type of analysis is used in political speeches where certain words are analysed to try to envisage the meaning of the writer. When studying texts these must be studied as products of the society that produced them. For example if we are studying a Second World War speech by Winston Churchill we have to keep in mind the political situation of the time. If we look at his speech "We shall fight …" we see that he uses these words seven times in rapid succession. Content analysis is about the intended content (i.e. the meaning which the author intends to portray) and the received content (the meaning constructed by its audience). It is the difference between the two that makes up the crux of content analysis.

Let us go back to Churchill's speech…:

> We shall go on to the end, **we shall fight** in France,
>
> **we shall fight** on the seas and oceans,
>
> **we shall fight** with growing confidence and growing strength in the air, we shall defend our Island, whatever the cost may be,
>
> **we shall fight** on the beaches**,**
>
> **we shall fight** on the landing grounds,
>
> **we shall fight** in the fields and in the streets,
>
> **we shall fight** in the hills;
>
> **we shall never surrender**, and even if, which I do not for a moment believe, this Island or a large part of it were subjugated and starving, then our Empire beyond the seas, armed and guarded by the British Fleet, would carry on the struggle, until, in God's good time, the New World, with all its power and might, steps forth to the rescue and the liberation of the old. (Churchill, 4th June 1940)

This speech uses repetition to encourage and fire-up the soldiers. If we look at the intended content we will refer to the word "fight" as the most important word. It is obvious that Churchill wants to encourage his soldiers. However there is also the received content from the soldiers. Hearing this speech, soldiers will not only feel encouraged to fight, but there is the hidden message of the greatness of the Empire. The message is not only about the courage to fight, but on the fact that the British will win because of the greatness of the Empire and the British fleet, however, if by some strange happenings they will lose, they will be saved by the New World because God is on their side.

Before you start to conduct content analysis you need to decide on the following:

1. What level of analysis are you going to take i.e. which words/set of words would determine a concept e.g. should we take "we shall fight" or "fight"

2. What is the number of concepts you will code?

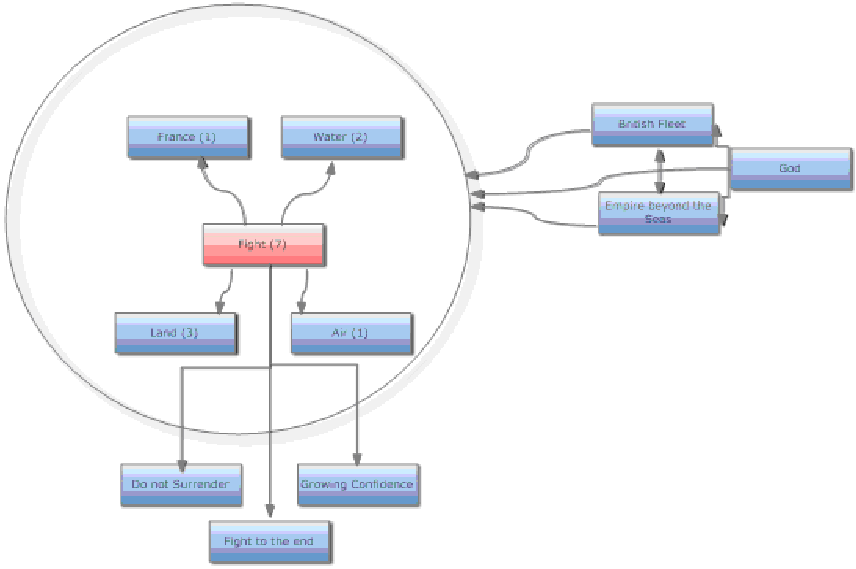
3. Are you going to code for existence or frequency?

4. How are you going to distinguish between concepts? – e.g. fight and defence.

5. You also need to develop a set of rules

6. What are you going to do with the irrelevant information?

At this point you need to start coding the text to construct a mind map of the speech. If we take the above speech a mind map of the speech would look something like this:



The final step would be the analysis of the results. The mind map above shows that fighting is central to the speech. However there is also a mention of God's help, the greatness of the empire and the British fleet. Analysing a number of speeches one could come out with a set of variables that is common in all the war speeches.

Mind maps are also good when you are starting to think about your dissertations/project proposal. It is a way of helping you analyse your thoughts. By drawing out the connections throughout your variables, you will realise where the flaws in logic are as well as which area you will be studying. Constructing a mind map would help you delineate the connections of your study. It would also help you develop your idea. Therefore by using mind maps, you will be able first to expand your topic and later to narrow it down so that it would be manageable.

CRISOLA Model

The conceptual model thus lays the groundwork for a completed model that can allow for predicting what could happen over time and space. The next sections look at this process from the point of view of a real model, created in a study on crime (Formosa, 2007). This model is termed **CRISOLA**. It attempts to create a predictive structure through the analysis of spatio-temporal elements.

It takes the reality of the PRESENT but looks into the FUTURE. This requires not a mere crystal ball viewing but extensive knowledge of the PAST

The main area of study is the interaction between:

- the **crime characteristics**
- the **social characteristics**
- the **physical characteristics**

In a study (Formosa, 2007) carried out over the period of 1997-2007, the topic of environmental criminology elicit some interesting research pathways that emanated from both the issue on data availability and access as well as the methodology used to understand the linkages between the different entities. A model was created to ensure that an understanding of all the parameters was established. This was not an easy enterprise as most datasets are either non-existing or non-available.

Why create a conceptual model?

Such a question lingers through the process of any literature review and in this study there was an amalgamation of the environmental criminology literature, the GIS literature and the Maltese scenario readings. The reviews, together with an understanding of the complex Maltese data availability situation, highlighted the need to bring together each aspect. It also helped to build a mind map that helped set out a process to depict a basic and generic model on how crime, social and landuse issues interact together. The review process also identified techniques and datasets that can be used in the identification and understanding of crime. The use of these datasets is best explained through a conceptual model that is relevant to **CRI**me and to the **SO**cial and **LA**nduse aspects, embedded as the acronym **CRISOLA**.

The model took shape through a tiered 3-phase process, with each iterative phase building up from an abstract level (Phase 1) through the identification of the main datasets (Phase 2) to a final individual attribute listing (Phase 3). The model is not exhaustive as it covers potential datasets that yet need to be created/surveyed, statistical measures identified as well as the inclusion of other crime-relevant theories. The model can be evolved in future studies as it attempts to highlight areas of study that will not be tackled in this research and which may/may not be found to be significant, entailing further change.

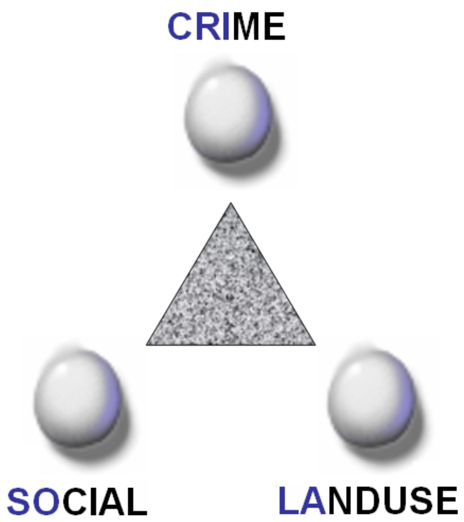
The three CRISOLA radials: Crime, Social and Landuse

Initially the conceptual model catered for the crime aspect in isolation, but crime does not stand alone: it interacts within a wider and more complex environment. The mind map exercise soon sought the inclusion of social and landuse parameters within the model aimed at streamlining the process to facilitate the analysis. The result brings together the three CRISOLA disciplines and attempts to identify theoretical links between the different datasets.

The decision to model crime together with the sociological and landuse disciplines is based on an understanding of the interactivity between the three as identified in the literature. The model attempts to understand criminal activity within the social and physical structures it operates in.

The main area of study is the interaction between:

i) the **crime characteristics** through an analysis of offender and offence composition and the interactivity between them;
ii) the **social characteristics** of an area through an analysis of its poverty/deprivation;
iii) the **physical characteristics** of an area, particularly its landuse, structural and zoning parameters.



The social characteristics of a human society are linked to the physical surroundings it operates in, which two characteristics are directly caused by or affect crime. Offender analysis requires an understanding of the social construct that the offender operates in, such as affluence and poverty. Offence analysis requires an understanding of the landuse structure crime occurs in; the opportunities offered, the mode of travel, and the activities that may lead to the occurrence of crime, amongst others. Theories covered in the study were inclusive of Environmental Criminology (or Urban ecology).

Phase 1 – The Abstract Level

Table 8.1 outlines the Phase 1 thought-process needed to reach an initial structure within which to analyse any relationships between the three disciplines. It is a high-level abstract model that attempts to look at parallel processes between the three disciplines and how an understanding of the processes can be achieved. It develops the concept through a series of five linear steps that can be tackled in order to facilitate later cross-thematic crime studies. It is aimed at an analysis of the thematic structure, focusing on the main parameter in the themes that affect change, identifying the spatial construct within the theme, highlighting the impact on capital and cohesion and finally leading to a change phase.

The latter phase can only be tackled through longitudinal studies that would draw a better long-term picture of what constitutes change. Although the current study looks at crime over a period of time, this model needs to be revisited with longer-term data if one needs to analyse sturdier change processes. This is needed particularly in the final phase that covers change for each of the CRISOLA themes.

Table 8.1: Phase 1 - Conceptual Model Logical Matrix 1

Social		Crime		Urban
Analysis of the Social structure of the area under study		Analysis of crime in the area under study through offences and the behaviour of offenders		Analysis of spatial constructs through a study of landuse zoning, spatial aggregates and physical structures
↓		↓		↓
Focuses on socio-economic and socio-cultural parameters towards an understanding of poverty and deprivation as a surrogate for social and community health		Focuses on offences as a measure of attractiveness of an area and focuses on offender data as a measure of social disorganization		Focuses on landuse zoning as a measure of affluence, leading to an understanding of opportunity structures
↓		↓		↓
Identifies the social-spatial constitution of the areas, leading to a social-zoning structure		Identifies the criminal-spatial constitution of the areas leading to a crime-zoning structure		Identifies the physical constitution of the areas leading to a landuse-zoning structure
↓		↓		↓
Impact on social capital – social cohesion		Impact on security and safety		Impact on spatial capital
↓		↓		↓
Social change		Crime change		Landuse change

Phase 2 – Identifying the linkages

Whilst, the high-level Phase 1 Model enables a generic focus on the study in question, a more detailed second level model was required which helped point at and identify the interactivity between the three parameters. This is accomplished preferably through the identification of datasets that may be used for analysis. Being a mind map model, Phase 2 (Figure 8.5) sought to identify those literature-related issues and integrate them within the model. It also sought to bring together the different: theories, datasets, spatio-temporal aspects, predictors and the main tenets that can be used in such a study on crime. These include such parameters as are age and density.

The deeper one moves into the model (towards the bottom part of each section and where the predictors are highlighted) the more research is needed to identify the real relationships and how each parameter can be predicted. The model does not attempt to solve these issues in this study but depicts the potential future studies that can be attempted.

The following walkthrough of the model in Figure 3.1 shows the three distinct social, crime and landuse sections. Each section has a series of data-boxes each depicting a specific theme, index or concept. The following section describes one such data-box.

A Social section walkthrough: Taking the proximity data-box as an example

Refer to the Phase 2 data model and identify the proximity index data-box within the Social section.

The proximity index attempts to elicit an understanding of each area in Malta through its location in relation to proximity to a number of factors. These are split in two:

i) the proximity to the community centre (identified by the number 3, which number also refers to the relative Phase 3 data-box) and
ii) structures identifiers split into four themes,
   a. two related to building state such as vacancy (4) and dilapidation (5) (indicates broken windows-tipping) and
   b. the other two related to densities – population (6) and dwelling (7).

The latter four would together be developed into a structural poverty index (8) that would be integrated with the proximity to the community centre theme. These two constructs would enable the creation of a spatial poverty index (9) that introduces a concept which identifies that poverty is not essentially an economic construct but is also related to access to the community construct. Taking the model further, integrating the socio-economic poverty index (10) created through a separate integration process, with the spatial poverty index (9) would result in a deprivation index (11). This process is followed by a statistical measure that would eventually result in the identification of a categorisation of different social zones (12).

It is at this stage that the first cross discipline links are highlighted: those of the identification of a possible link between social zones (12) as identified through the process described above and the potential relationship (brown link) to the offender location (37) that looks at the social zoning pertaining to convicted offenders. This link can be further analysed through statistical measures. Other potential cross-discipline relations are identified through the link between the social (poverty) zones (12) and the landuse social and community-related zones (15). This link could better describe the relationship between the 'poor' areas and their location in the landuse designated for social use as against industrial and recreational use. It may identify 'poor' areas that are situated outside of the social zones as well as concentrations within specific areas of the social zones. Other lower-level links between the different themes would relate to the linkages between the final level of each theme and the potential impact on each resulting in a change in the other. The social zoning (12) to landuse (27) link is such a potential link (red line) where one could predict changes in deprivation through changes in the landuse construct and vice versa.

The other sections follow the same logical process and each successive branch highlights its particular theme, theory base and dataset pertaining to it. The best way to follow this is within the model is to once again look at the proximity index example in Figure 8.5. The level 2 model in Figure 8.5 is accompanied by a description and spatial levels key (Figure 8.6). The key describes the different spatial data aggregates available from national to regional to enumeration areas, which data layers can be employed for most datasets listed. The description section, however lists the different datasets available (D), the theories (T), the main data tenets (M) as well as other relevant information.

Once again, taking the proximity index as an example, the proximity-to-centre data-box (3) is tagged with 3 codes, amongst them D2A. The D2A refers to the key: Data (D) is available at (2A) Address-point spatial detail. Similarly the vacancy (4) data-box is tagged with T3A and D2I, where as an example T3A refers to social disorganization theory and potential to analyse the data based on concentric rings and broken windows concepts.

Other model issues include the identification of a potential to integrate a dark figure of crime, once this is carried out. To date, this has not been covered in Maltese crime studies, except for a crime victimization study in the 1990s, which was never published and another study carried out by Formosa in 2007 where the sample return was too small to prove reliable.

The coloured data-boxes indicate some kind of major studies that were not found in the literature review but are deemed essential to understanding crime, such as the analysis of spatial-temporal-prediction-fragmentation (31) which attempts to understand the spatial aggregate (ex: council, enumeration area, street) at which predictability starts to deteriorate over time and which would allow researchers to know how far to predict at each level in order to remain statistically significant. Such a model would help crime understanding for operational and tactical levels.

Phase 3 – Identifying the datasets and attributes

Taking the model one step further to Level 3 (Figure 8.7), a series of statistical measures are listed for the variables within each dataset identified for model integration. This level is theoretical as each link needs to have a theoretical construct attached to it with the relevant research studies carried out which would validate that such a model can work.

The Phase 3 is highly detailed where it looks at each data-box, identifies the relative dataset as indicated in Phase 2, lists the attributes within that dataset and then attempts to identify statistical measures for each level within the process. In most cases, the statistical measures call for further research into the potential measures to be employed. Also, at this stage new indexes were inputted such as insurance, sentencing practice and recidivism, each of which was identified as vital to a particular complex index.

As in the Phase 2 case, the best way to understand Phase 3 would be through an example, that pertaining to the proximity-to-community-centre data-box (3). In Phase 3, a statistical measure is listed as distance-to-centre which is further explained through the use of a distance ranking index based on GI buffering techniques employing 100m intervals.

New indexes are also identified in Phase 3, which indexes help to clarify how a more complex index is created. The following example is based on the welfare index (2) that is split into two component indexes (persons-at-risk and structural-dependency). Each of these is composed of three data complexes (ex: pensions, social assistance, widows survivors), where each complex is composed of the sum ($\sum$) of a number of welfare benefits pertaining to that category (attributes within the welfare index dataset). For example, Widows survivors is composed of Widows pensions (NM and NMWP), Survivors pension (SRP and ESRP). The results are then integrated with other categories as in the Phase 2 process described earlier.

Conceptual Model Summary

In summary, the main aim of producing these three Phases was primarily targeted at understanding the potential relationships between the CRISOLA constructs. These relationships operate within a human environment that is intrinsically dynamic, where any change in one sector would affect the other two, positively or negatively. The model will be used post-research to further refine the theories and carry out in-depth studies in each of the sectors and linkages.

The conceptual model was drafted to enable the author to focus the direction this study would take though the identification of some of these areas that can be analysed, whether data exist to support such studies and also to identify further areas of research. It also helped to list the relevant theories, the data availability, the spatial and temporal aspects and the potential relations between the different CRISOLA constructs.

Once the model has been drafted, the next steps of the research development process would entail the running of the relevant queries, studies and analysis as described in the earlier chapters. The next chapters will entail a study of the tools available for such study purposes.

Questions (refer to Appendix for the answers)

1. Briefly explain what mind mapping is.
2. What is a "model" (with reference to research and mind mapping)?
3. List the six main steps when it comes to creating a mind map.
4. List the main players in a mind map.
5. Different research stakeholders have different level of needs. Mind maps are designed, keeping in mind the requirements (levels of need) of people in different roles with their different perspectives. List these roles/perspectives.
6. A conceptual model has to keep in mind three important dimensions within which that model operates. List these dimensions.
7. Building a model – moving from a conceptual model to a working model – requires a process based on Peuquet's (1990) three stages. List these three stages.
8. Briefly explain what you understand by "content analysis".
9. What does CRISOLA stands for? What is CRISOLA's main area of study?

Figure 8.5: Conceptual Model Phase 2 – Linkages – Themes - Key 1

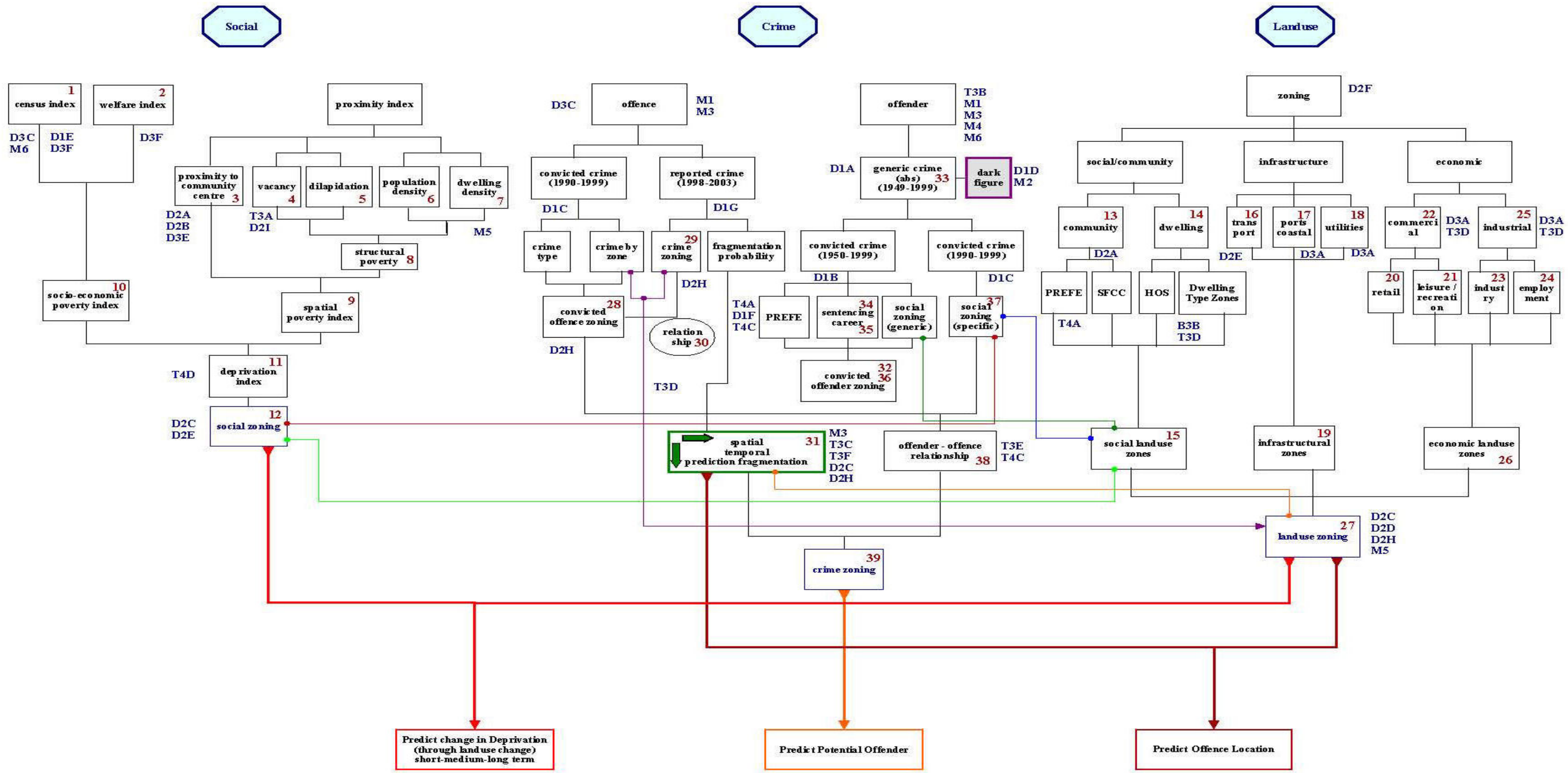


Figure 8.6: Conceptual Model Phase 2 – Linkages – Themes - Key 2

Data (D)

1) Crime Data

a) 1949 - 1999 (Abstract of Statistics - Historic)
b) 1950 - 1999 (CCF Offender)
c) 1990 - 1999 (CCF Offence)
d) 2000 - 2005 (dark figure
e) 2001 (education absences police)
f) 1993 - 2004 (Enforcement development cases)
g) 1998 - 2003 (police reported crime)

2) Landuse Data

a) Address point
b) Basemap extractions
c) Boundaries
- streets
- enumeration areas (EAs)
- councils
- regional
  - local plan areas (LPAs)
  - police
  - health
  - census
  - NUTS (5-1)
  - conurbation

d) Planning applications
e) Transport
- roads
- streets - Link Tables
- bus routes

f) Urban - rural
- development zones
- zoning

g) Urban Conservation Areas (UCAs) / village cores
h) Development PLAN (base map extraction)
i) Maltamal (utilities - vacancies - migration)

3) Social Data

a) Economic
- town centers
- recreation
- retail
- industry
- employment

b) Housing zoning - HOS
c) NSO - socioeconomic Census 1995
d) Welfare - 1995 - 2003
e) Education
f) Health

Theories (T)

1) Rule relativist - social construct
- space
- time

2) Radical conflict - human rights
- law
- (power)

3) Environmental criminology

a) Social disorganisation
- concentric rings
- broken windows

b) Offender
- individual
- family
- community
- country
  - careers
  - networking

c) Offence
- zoning
  - urban / rural
  - housing market
  - commercial
- victimisation
  - networking
- defensible space

d) Opportunity
e) Routine activity
f) Predication fragmentation probability
- space
- time
- thematic

4) Sociological

a) PREFE
- Politics
- Religion
- Education
- Family
- Economy

b) Networking
c) Structuration (3b-3c)
d) Deprivation
- Poverty - Absolute / Relative

Main Tenets (M)

1) Age

2) Dark figure

3) Seriousness

4) Recidivism

5) Density

6) Unemployment

Spatio-Temporal

1) Thematic (H)

2) Spatial (S)

3) Temporal (P)

All datasets in model are:

1) Spatial
2) Thematic across
- social
- landuse
- crime zones

3) Temporal

a) 1950 - 1999 (base data - offender / crim)
b) 1990 - 1999 (specific period - offence)
c) 1995 - 2003 (reported crime - geopol)
- (census)
- (social data)

d) Landuse data
- current
- 1990 - 2004

Predictors

1) Potential offender - TURF

2) Potential Offence - SHIFT

3) Potential Deprivation - SHIFT

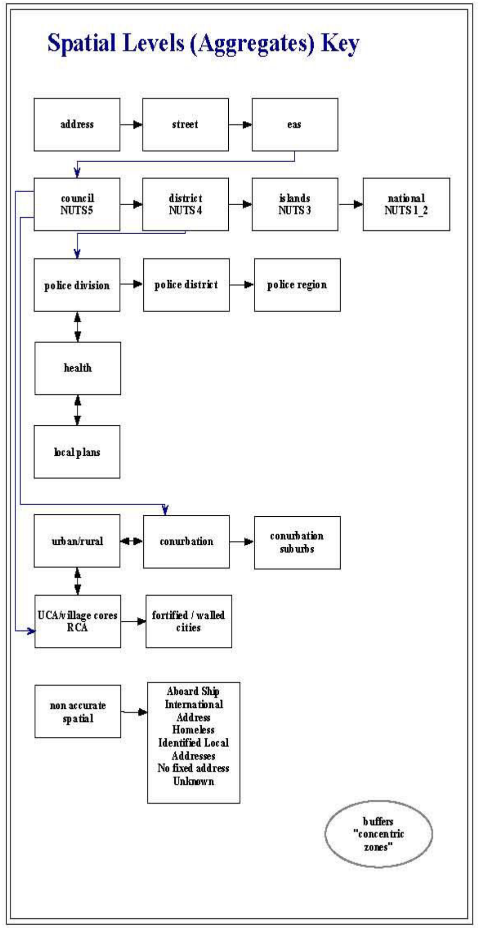


Figure 8.7: Conceptual Model Phase 3 – Datasets, variables and Statistical measures model