
Students Learning with Communities: All of these projects were undertaken in collaboration with community partners and supervised by academic staff members

DIT Access and Civic Engagement Office

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The Lifeline Project: Knowledge Acquisition and Modelling Assignment Report

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The Lifeline Project

**Knowledge Acquisition & Modelling Assignment Report for
DT217 - MSc Computing (Information & Knowledge Management)**

**In collaboration with
DIT Students Learning with Communities
June 2012**

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We gratefully acknowledge the support, assistance and cooperation of the following:

Kaethe Burt-O'Dea, MSc Arch AEES
Lifeline Project Founder & Co-ordinator

David O'Connor
DIT Lecturer, Spatial Planning and Transport
Community partner in Lifeline project

Gerard Doyle
Lifeline Project Volunteer

Dr Catherine Bates
Project Co-ordinator
Community Links
DIT Students Learning With Communities

Deirdre Lawless
Lecturer,
MSc in Computing Programme Co-Ordinator
Dublin Institute of Technology

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INTRODUCTION

This assignment was undertaken in partnership with the Dublin Institute of Technology *Students Learning with Communities* programme. *Students Learning with Communities* promotes and supports community-based learning and community-based research initiatives for mutual benefit.

The assignment was undertaken as part of a Knowledge Acquisition and Modelling module by the following MSc Computing (Information & Knowledge Management stream) students:

- John Brogan Student ID: D11125025
- Marcus McQuiston Student ID: D10125244
- Leah Moriarty Student ID: D11126243
- Christina Shannon Student ID: D11123520

The Lifeline Project

The Lifeline Project is a broadly-based community project grounded in “experiments in living systems technologies”. It is a citizen-led action-based project located in Dublin 7 and as such is an exercise in social constructivism. A reference for the Lifeline Project is the Highline Project in New York. The Lifeline Project was founded in 2007/2008 by Kaethe Burt-O’Dea who resides in Dublin 7.

The Issue

The co-ordinator of the Lifeline Project, Kaethe Burt-O’Dea, has a very significant level of tacit knowledge. The core issue is that the majority of the active Lifeline knowledge-base is tacit. Of approximately 50 individuals involved with the project, the primary driver and knowledge source is the founder herself. If for any reason Kaethe is unavailable, all project progress slows. At first review, there appears to be an issue with the externalization of knowledge. Using Nonaka’s Spiral of Knowledge Model (see figure 1 below) the knowledge flow has stalled at the externalization stage. Knowledge does not appear to be transferring in any explicit manner.

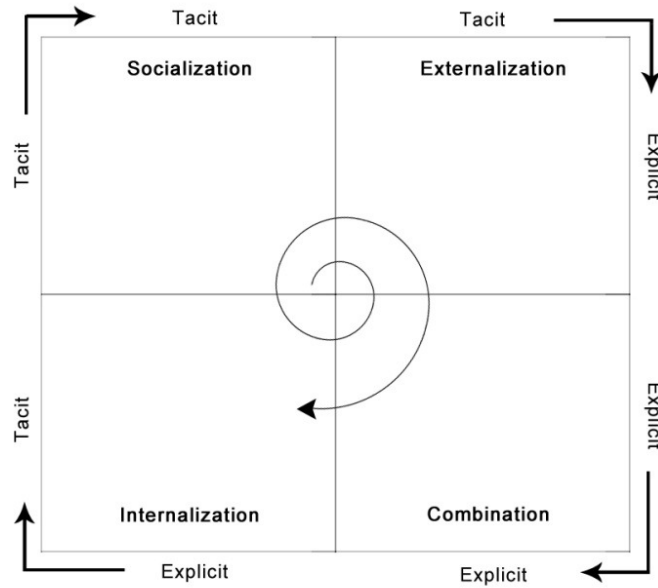


Table 1: Nonaka's Spiral of Knowledge Model

A very significant amount of the Lifeline's knowledge base appears to be tacit. There is a definite need to capture the founder's vision and how it is comprised, in order that the Project may progress in her absence. Similarly there is an issue with how people interact and participate with the project in any formal codified manner. There is no formal mode of interaction nor scheduling of participation. Rather activities and interactions appear to be in an *ad hoc*, unrecorded but creative manner. The scenario as described is a classic Knowledge Management issue – how may tacit knowledge be converted into explicit knowledge.

Following discussions with Deirdre Lawless (DIT Msc in Computing Programme Director) and Catherine Bates, *Students Learning with Communities*, a requirement was confirmed to describe the depth and breadth of the Lifeline projects in as clear and comprehensive a manner as possible.

KNOWLEDGE ACQUISITION AND ELICITATION

1 Acquisition

Artefact analysis : we undertook a site visit of the Grangegorman locale. We reviewed as many online materials related to Lifeline project as we could find. This included multimedia materials on Flickr, Vimeo, YouTube, Facebook and LinkedIn. This was in order to understand more about the Lifeline Project and Kaethe Burt O'Dea, the Lifeline Project's founder and visionary.

Additionally a meeting took place in DIT with all participants, the Lifeline founder and the Lifeline website designer. This meeting was to agree the scope and outputs of the Assignment. It also provided an opportunity to hear what the Lifeline project was about in broad terms. This meeting allowed the Assignment team to agree the best most comprehensive approach to an elicitation.

2 Elicitation

It was decided we would conduct an oral face-to-face semi-structured interview between Kaethe Burt-O'Dea and team members John Brogan and Marcus McQuiston. A subsequent interview was conducted with David O'Connor, DIT Lecturer in Spatial Planning. Both interviews were recorded. During both interviews we also took notes and drew simple mind maps to record concepts and themes as they arose. The interview transcripts are included in the appendix.

In total, therefore, two lengthy interviews were conducted as part of this project.

The first interview with Kaethe Burt-O'Dea was conducted by John Brogan and Marcus McQuiston. Kaethe Burt-O'Dea is founder of Lifeline, current project co-ordinator and an individual with a very large personal knowledge bank on urban activism, healthcare design, engaged living, urban ecology and other key issues core to the Lifeline project. The interview with Kaethe Burt-O'Dea which was conducted on Friday 30th March, 2012 was of a duration of 119 minutes and generated a transcript of almost 13,000 words.

The second interview with David O'Connor was conducted by Marcus McQuiston and Christina Shannon on Thursday 19th April, 2012, lasted approximately 45 minutes and generated a transcript of approximately 5,000 words. It was decided to interview David O'Connor as a person with a keen interest and experience of the Lifeline project both through his work in DIT and as a person who had volunteered locally. David O'Connor provided both a validation of the work of Lifeline in its many guises and also provided a different perspective of the project.

3 Reinforcement/verification or validation

We chose the acquisition process and elicitation techniques for the following reasons:

- The Lifeline project has little or no formal structure. There is very little formal project documentation. Face to face interviews were the only realistic choices.
- As stated earlier, there is primarily one individual behind the project. Kaethe Burt O'Dea is the visionary and the leader. Everything in the project follows from her thoughts and actions. The best means to elicit her opinions, motivations and knowledge was via a semi-structured and in-depth interview. A simple observation of her daily actions associated with the Lifeline project was not feasible given the time box constraint of the assignment.
- We have been advised the Lifeline project is very ambitious, far ranging and difficult to encompass. We had also been advised that project funding opportunities were being missed due to the fact that the Lifeline concept had not been summarised and described in as simple and comprehensive manner possible. KBOD's vision had not been captured and tested adequately. Thus one of our outputs, the Concept Map, will be very useful artefact.
- Interviewing and then transcribing is undoubtedly an elicitation process bottle neck. However as we will see the analysis provided some interesting insights.

TEXT ANALYSIS

Given the range of topics covered in both interviews, the broad-based, multi-disciplinary nature of the Lifeline project and the perspectives offered by both interviewees it was decided to perform a text analysis of both interviews. Text analysis software enables users to analyse specific texts or groups of texts and, among other things, determine the frequency with which words or phrases are used, view words in context, study patterns in texts, create text matrixes and compare different documents with regard to text, views and concepts contained therein. Specifically from our perspective it was considered that an analysis of the transcripts of both interviews would be useful in a number of areas which would inform both our understanding of the project and also inform and aid the development of the conceptual model. In particular, given the amount of tacit knowledge which the first interviewee, Kaethe Burt-O'Dea, possessed in a wide variety of areas, it was determined that a detailed analysis of the interview transcript would provide a more comprehensive understanding of the Lifeline project and associated issues. The use of text analysis software would, it was considered, be of use to compare both interview transcripts and enable evaluation of any contrasting perspectives for both interviewees. It was also considered that an analysis of both interview transcripts would add to the quality and depth of the insights provided by the interviewees about the Lifeline project.

Software Evaluation & Outcomes

Two software products were initially evaluated with respect to our requirements outlined above. These were *nVivo* and *MaxQDA*. Following evaluation, it was decided that *MaxQDA* offered the functionality, ease-of-use and features to meet our requirements. Accordingly, *MaxQDA 10* was used for these purposes and the products of the text analysis of both interviews helped inform and assist in our understanding of the Lifeline project and, further, in the generation of the conceptual model. *MaxQDA* is a commercial product which is used for text evaluation/analysis and qualitative data analysis, and assists users in systematically evaluating and interpreting texts.

A number of documents have been generated using *MaxQDA* which have been instructive and helpful in informing our development of the conceptual model. Of particular interest is a Quote Matrix which includes details of specific areas covered in both interviews and allows comparison, evaluation and validation from the perspectives of both interviewees.

Also generated is a word frequency spreadsheet which indicates the frequency of specific words used in both interviews and which provides an interesting perspective as to the core issues behind the Lifeline project with respect to the views expressed both interviewees. This also allows comparison of the views of the interviewees with respect to specific aspects of the Lifeline project.

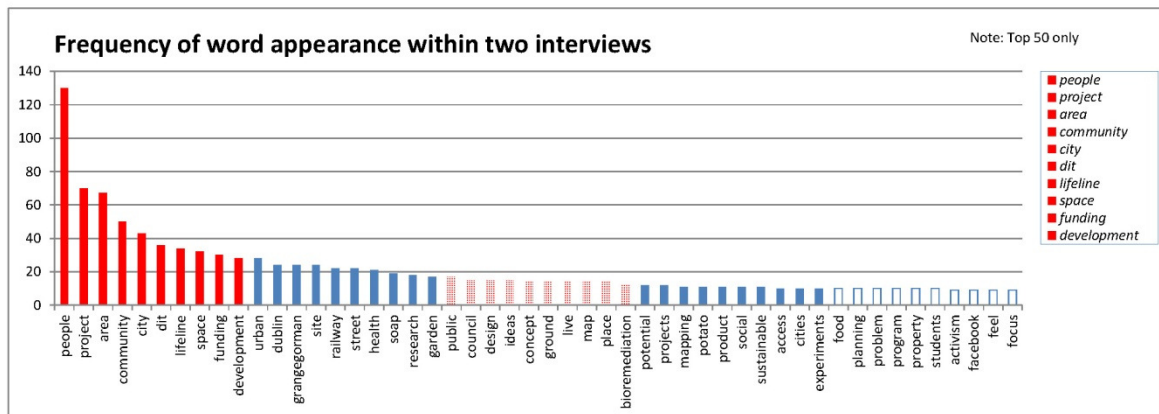
Following the completion of both interviews, it was necessary to transcribe these. Given the lengthy interviews (a total of almost 18,000 words) and especially the poor sound quality of the first interview with Kaethe Burt O'Dea which could be ascribed to the interview location in a public place, this was a time consuming process. A couple of transcription tools to assist in the time-consuming process of transcribing these interviews were evaluated. It was decided to use *Express Scribe* which is a transcription product developed by NCH Software (www.nch.com.au). This product was helpful in the transcription process and was used by all members in their respective roles in transcribing the interviews.

Code	All coded segments	All Codings (%)	Number of Documents
Publicity	2	2.86	1
Use of Technology	3	4.29	1
Background/Motivations	2	2.86	1
Urban Ecology	3	4.29	2
Projects/Products	13	18.57	2
Community Impacts	2	2.86	2
Volunteers	7	10.00	2
Bioremediation	2	2.86	2
Funding	5	7.14	2
Aims/Goals/Objectives	3	4.29	2
Stakeholders	3	4.29	2
Railway Line	7	10.00	2
Health	4	5.71	2
Demographics/Location	4	5.71	2
Grow It Yourself	2	2.86	2
Role of DIT	3	4.29	2
What Is Lifeline?	3	4.29	2

Table 2: *MaxQDA* codings (both interviews) showing themes identified.

The codings of themes expressed during the interviews clearly indicates the issues surrounding the Lifeline project. Unsurprisingly, the interviewees spoke in detail about various Lifeline projects, about the role(s) of volunteers in the project, about the relevance of the railway line to the project and about a variety of community and people-related issues central to the ethos of the Lifeline project. It is obvious from the above that the Lifeline project is a broadly based, multi-disciplinary project with many strands but with the community at its very core.

The understanding of the core issues surrounding the Lifeline project were reinforced by an analysis of the frequency of specific words used in both interviews. An analysis of word frequency was undertaken and this strongly highlighted the community nature and people-centric nature of the Lifeline project. With the removal of everyday or common linking words it became apparent that words such as “People”, “Community”, “Area”, “Project”, “Space”, “Site” and “Health” were strongly evident in this analysis. This is illustrated in the Tables below.



Word	Word length	Frequency of mention	%
people	6	130	0.72
project	7	70	0.39
area	4	67	0.37
community	9	50	0.28
city	4	43	0.24
dit	3	36	0.20
lifeline	8	34	0.19
space	5	32	0.18
funding	7	30	0.17
development	11	28	0.16
urban	5	28	0.16
dublin	6	24	0.13
grangegorman	12	24	0.13
site	4	24	0.13
railway	7	22	0.12
street	6	22	0.12
health	6	21	0.12
soap	4	19	0.11
research	8	18	0.10

Table 3: Top 20 word frequencies (combined interviews) - ranked.

As a further aid to validation and comparison of the views expressed by both interviewees, a Quote Matrix was generated from within *MaxQDA*. This clearly indicates the opinions of both interviewees with respect to the issues highlighted and provides a perspective from which the opinions and views of both can be compared and contrasted. A snapshot of the Quote Matrix Table is included below.

One very useful feature of *MaxQDA* is the Document Portrait feature which enables a visualization of a document via a collection of its coloured codings. This provides a visual analysis of a specific text via the generation of a ‘portrait’ of the codings contained in the document. A document portrait of both interviews has been generated indicating the themes covered during the course of the interview, the relative amount of time indicated in the codings and, interestingly, the structure of the interview. Note that the second interview with Dave O’Connor, appears more structured than the first with Kaethe Burt O’Dea. This is unsurprising given the significant amount of tacit knowledge possessed by Kaethe and by her own interview responses in the interview transcripts. Full size images of the Tables below are shown overleaf.

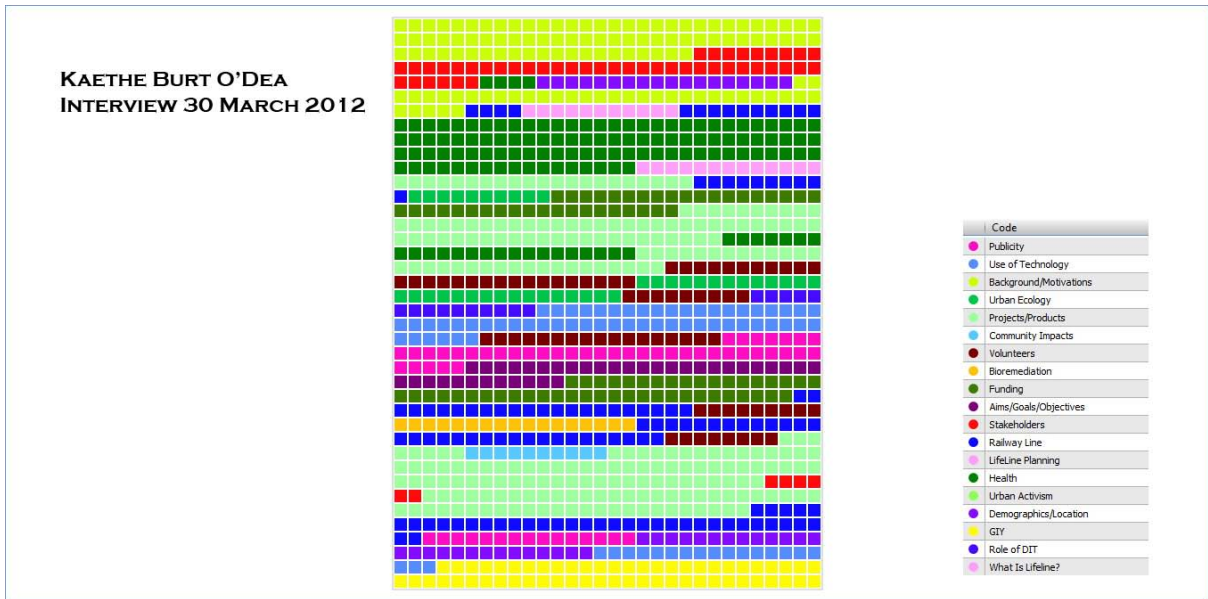


Table 4: Document Portrait of Kaethe Burt-O’Dea interview

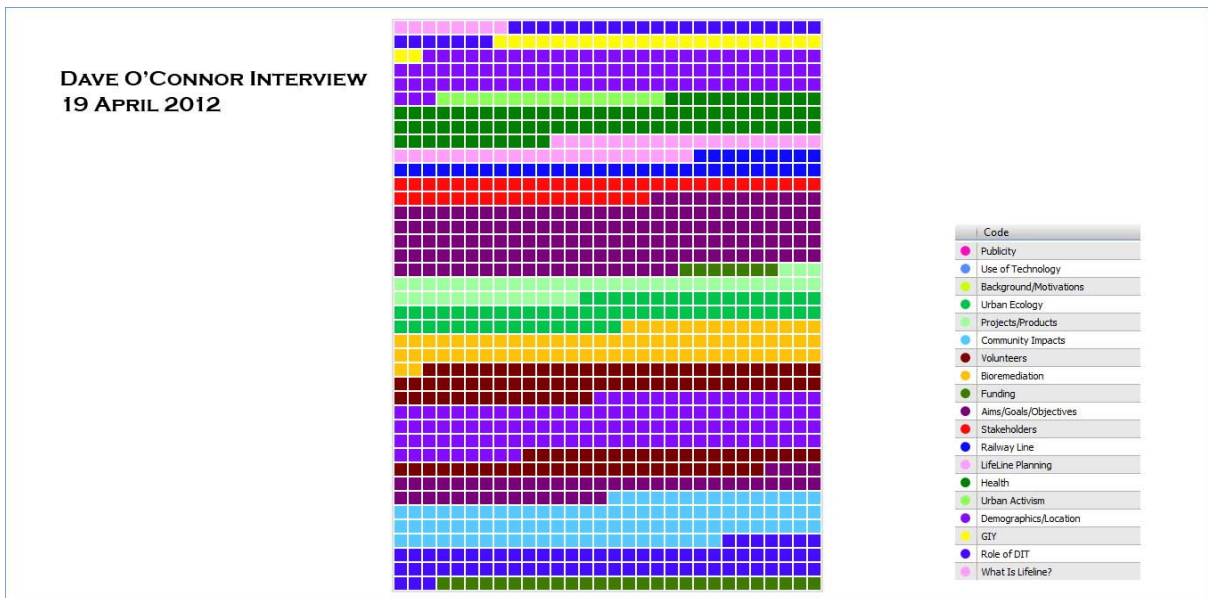


Table 5: Document Portrait of Dave O’Connor interview

In summary, the text analysis performed helped highlight the key issues identified by both interviewees. As such, it aided our understanding of the breadth and depth of the Lifeline project, provided a significant insight into the broad-based, multi-disciplinary, community based nature of the project and also provided key insights into the development of the conceptual model and, as a result, the representation. We conducted a detailed textual analysis of each interview; comparing and contrasting phrases between interviewees; interrogating and examining text for concepts; identifying concept linkages and prioritising associations, all using a number of pieces of software. We have visualized the results to aid presentation, interpretation and understanding.

CONCEPT MAP FOR LIFELINE

The concept map is a diagram showing the relationships between concepts in the Lifeline Project. The concepts, represented as circles, are connected with labelled arrows in a downward-branching hierarchical structure. This was produced in *Cmap*. Original *Cmap* files for enlargement and printing are included as separate files.

The map is the result of the expression of concepts and ideas acquired during the elicitation and subsequent analysis. Each informs the other; the analysis informs the *Cmap* and vice versa. The choices made of what to include and what to exclude were based on a process of continuous refinement namely:

- 1 the validation interview with David O'Connor
- 2 the textual analysis (see tables and figures attached) to extract the priority concepts
- 3 the quotation analysis to find comparative themes and contrast their expression between interviewees

An initial *Cmap* representing the Lifeline overview and overarching concepts was produced to supply context.

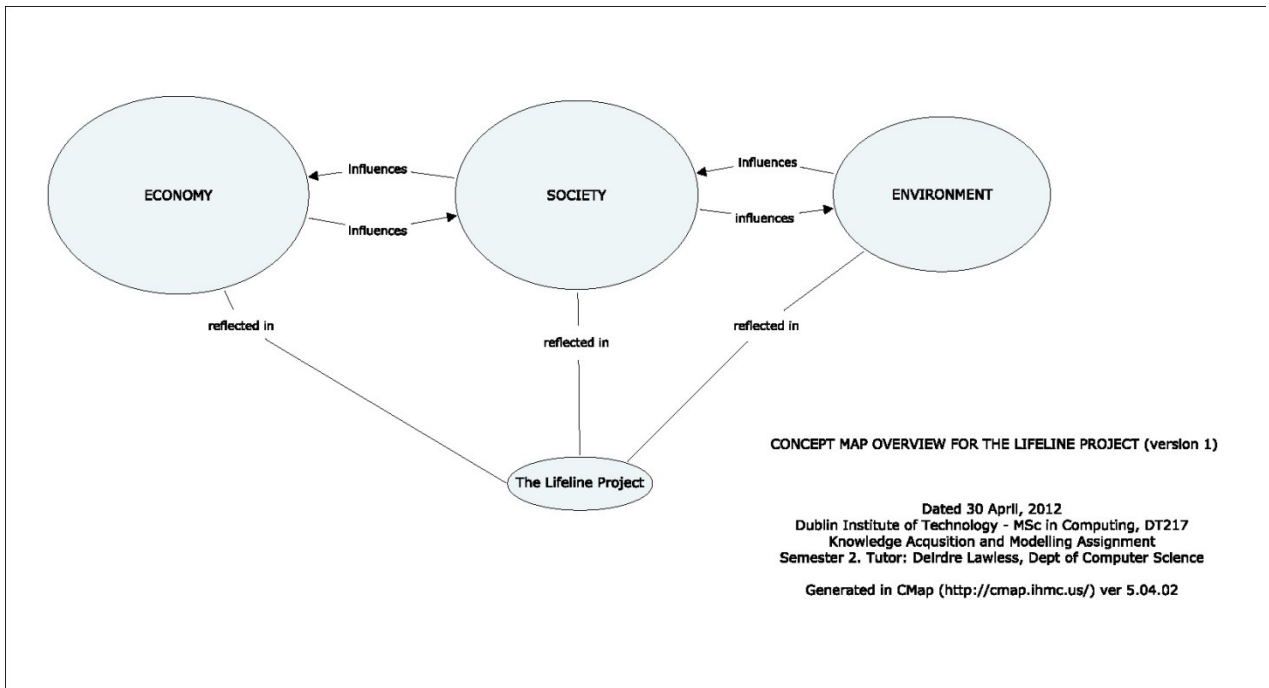


Table 6: initial Concept Map overview for the Lifeline Project

A detailed Concept Map capturing the core concepts, meanings and relationships of the project was also produced in *Cmap*.

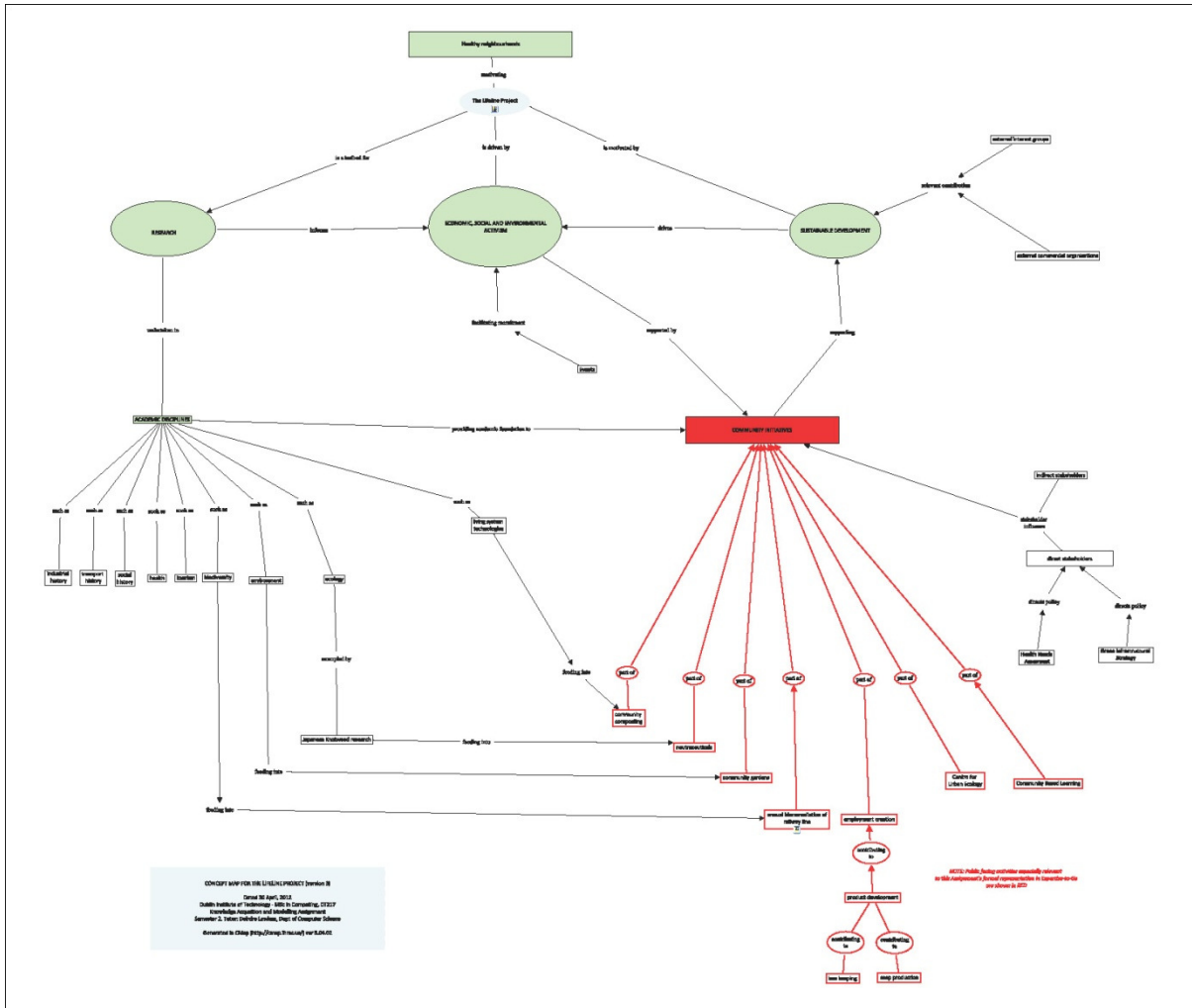


Table 7: Detailed Concept Map for the Lifeline Project

The relationship between each concepts is articulated in linking phrases such as "supports", "drives", "is driven by," or "is motivated by", "feeds into", and "facilitates recruitment into". The *Cmap* image attempts to convey how the multitude of KBOD’s individual ideas forms the more meaningful, bigger picture.

The linkages, associations and concepts marked in red indicate the public-facing participation opportunities for the project. It is these parts upon which we are producing our representation.

Our *Cmap* also details the linkages in and out of the key concepts. “Community initiatives” has 10 inward links and “Academic Disciplines” has 10 outward links. These numbers are the result of our elicitation and analysis. Lifeline is based on community and research themes.

Cmap List View **Lifeline Project: CMap concepts sorted by linkages (in and out)**

Concepts Linking Phrases Propositions Cmap Outline

Type a new concept and press Enter:

Concept	Links In	Links Out
COMMUNITY INITIATIVES	10	1
ECONOMIC, SOCIAL AND ENVIRONMENTAL ACTIVISM	3	2
employment creation	2	0
neutraceuticals	2	0
community composting	2	0
SUSTAINABLE DEVELOPMENT	2	2
direct stakeholders	2	1
community gardens	2	0
transport history	1	0
social history	1	0
Japanese Knotweed research	1	1
annual bioremediation of railway line	1	1
bee keeping	1	0
RESEARCH	1	2
living system technologies	1	1
tourism	1	0
Centre for Urban Ecology	1	0
ecology	1	1
soap production	1	0
biodiversity	1	1
industrial history	1	0
health	1	0
ACADEMIC DISCIPLINES	1	10
The Lifeline Project	1	3
environment	1	1
Events	0	1
NOTE: Public facing activities especially relevant to this Assignme...	0	0
CONCEPT MAP FOR THE LIFELINE PROJECT (version 3) Dated 30...	0	0
indirect stakeholders	0	1
Healthy neighbourhoods	0	1
Green Infrastructural Strategy	0	1
product development	0	3
Health Needs Assessment	0	1
external interest groups	0	1
Community Based Learning	0	1
external commercial organisations	0	1

Table 8: *Cmap* concepts sorted by number of inward and outward linkages

TIMEBANKING SOFTWARE EXPLORATION FOR POSSIBLE FUTURE USE BY LIFELINE PROJECT

Timebanking software was investigated as it was felt that this approach would be suitable for the next phase of the Lifeline project. Kaethe Burt O’Dea expressed an interest in this type of system in order to track the skills and offers of help that came from the community project participants.

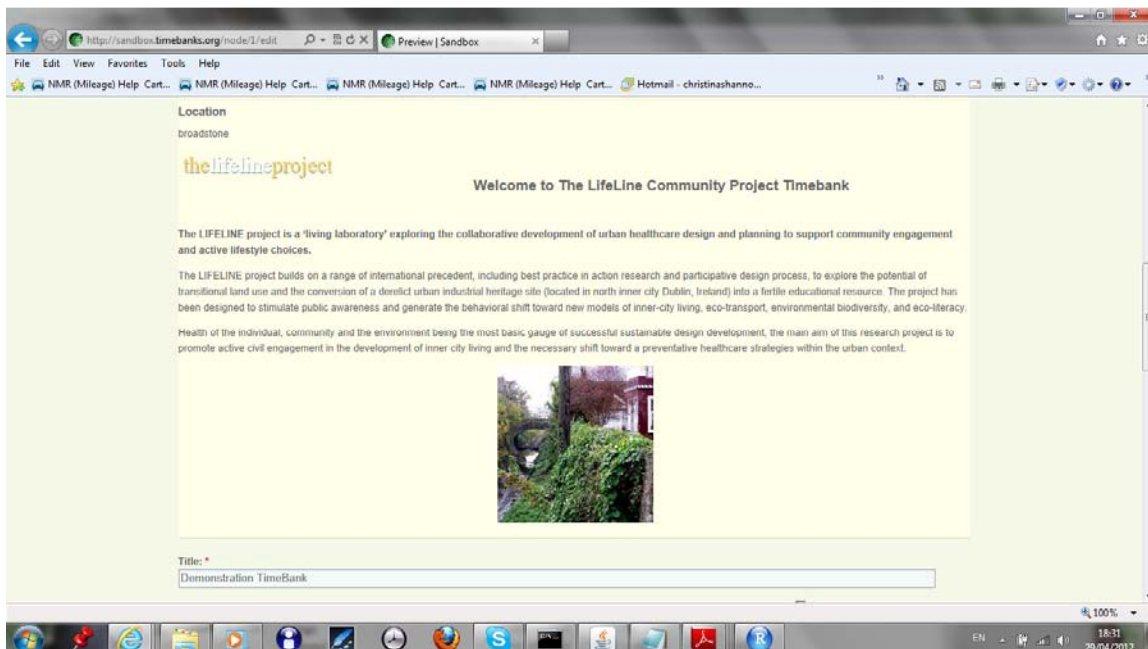
Research (websites and videos) was conducted and several timebanking systems were examined. Some were bespoke systems developed for particular community programmes. Community Weaver 2.0 (based on the Drupal content management system) was deemed to be suitable for the next phase of this project due to the fact that it is both open source and appears to address the requirements of the Lifeline project. Community Weaver 2.0 also has a demonstration sandbox site. Here a potential user can enter ‘dummy’ information and customise the look and feel of the site to get a picture of what the ‘live’ site would look like if chosen and deployed.

See <http://sandbox.timebanks.org/>

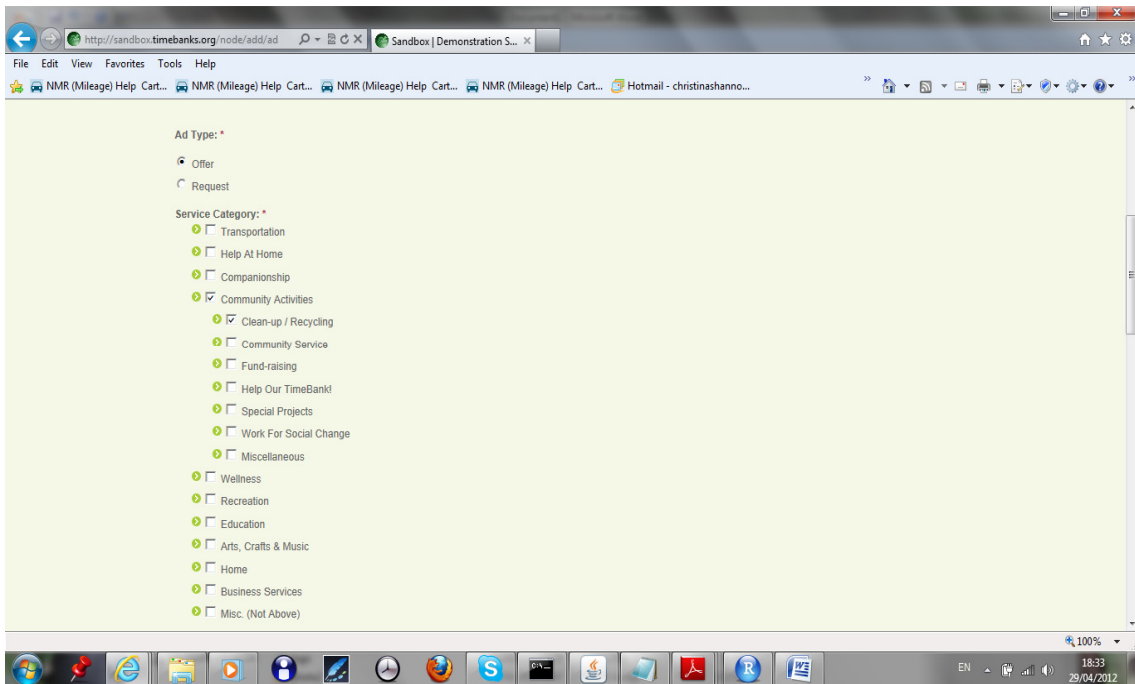
Considerable time was spent analysing this system and customising the sandbox site, by adding events and images pertinent to the Lifeline project. This interaction with the site demonstrated the ease of use, and further convinced us of the suitability of this system for the projects’ next phase.

Time constraints prevented us from implementing Community Weaver at this stage of the project. It could be implemented as part of a Masters dissertation in the future.

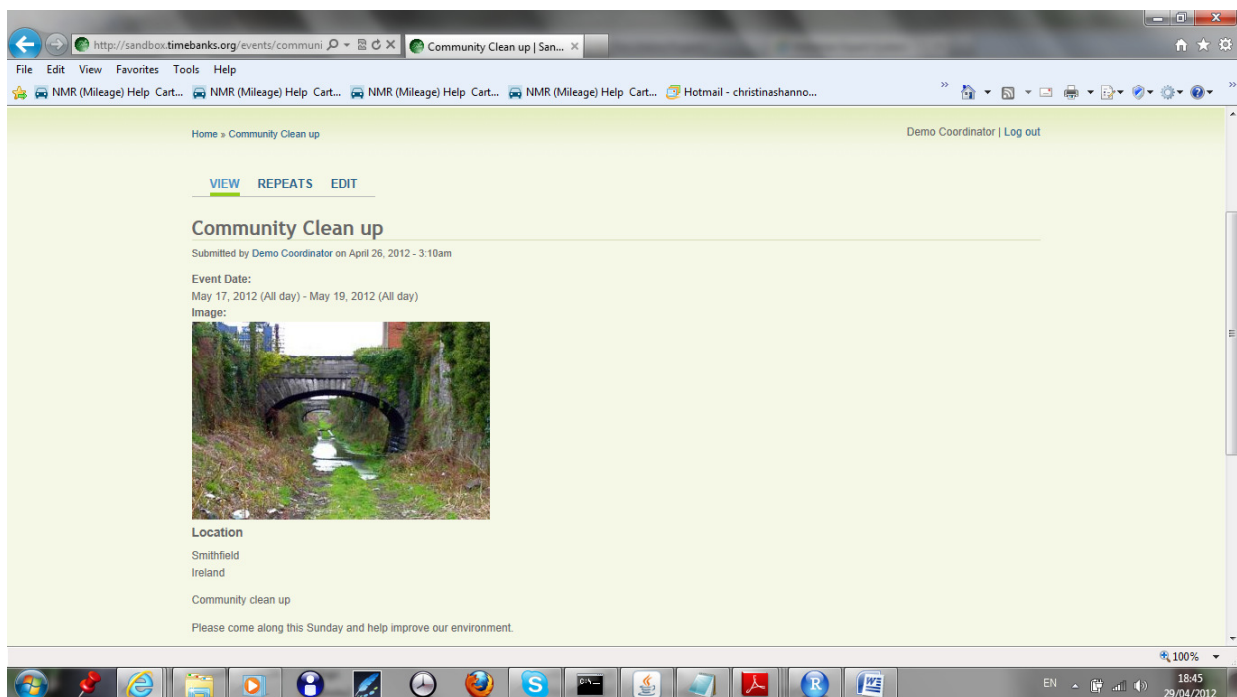
Sample screens from Community Weaver Timebanking system - developed in the demonstration Sandbox for Community Weaver 2.0.



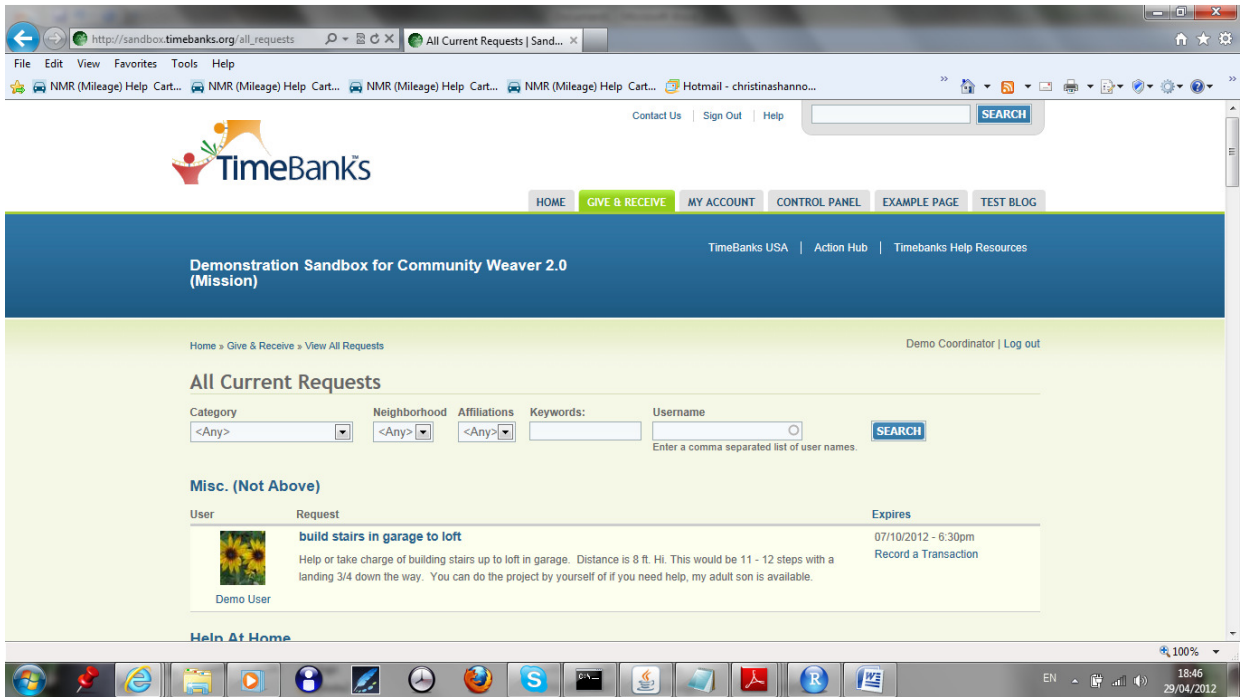
Sample Homepage – customised in the sandbox for our Lifeline Project



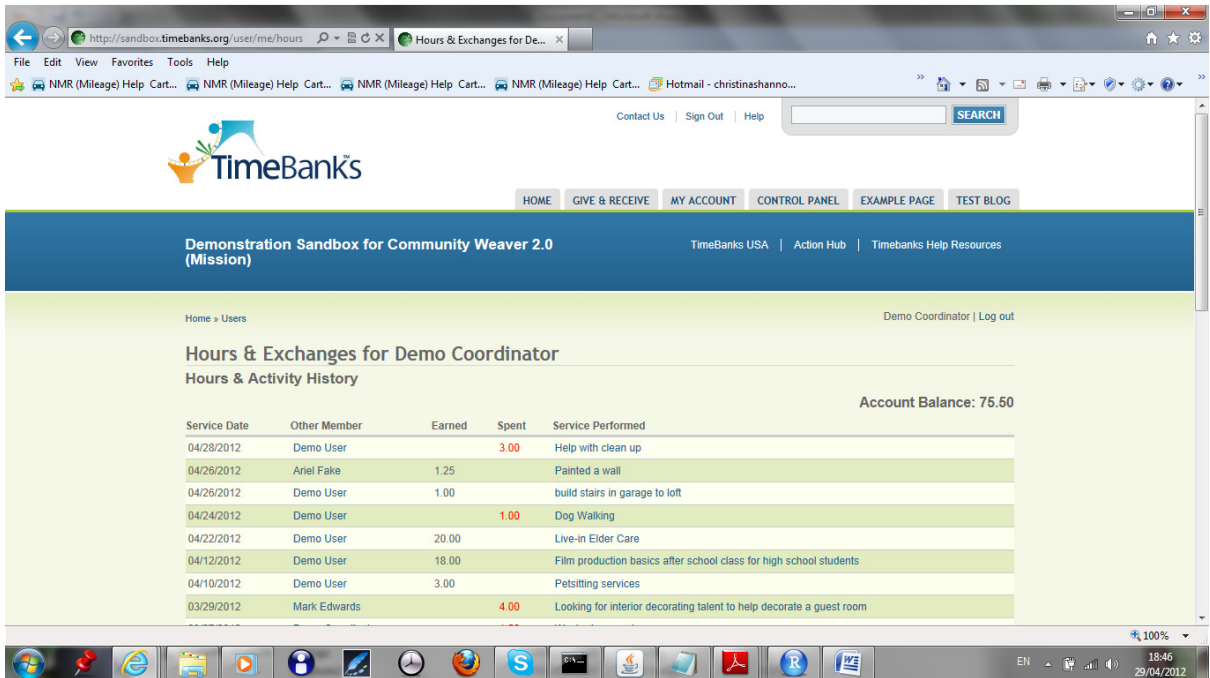
Categories of skills where Timebank participants can offer or request services



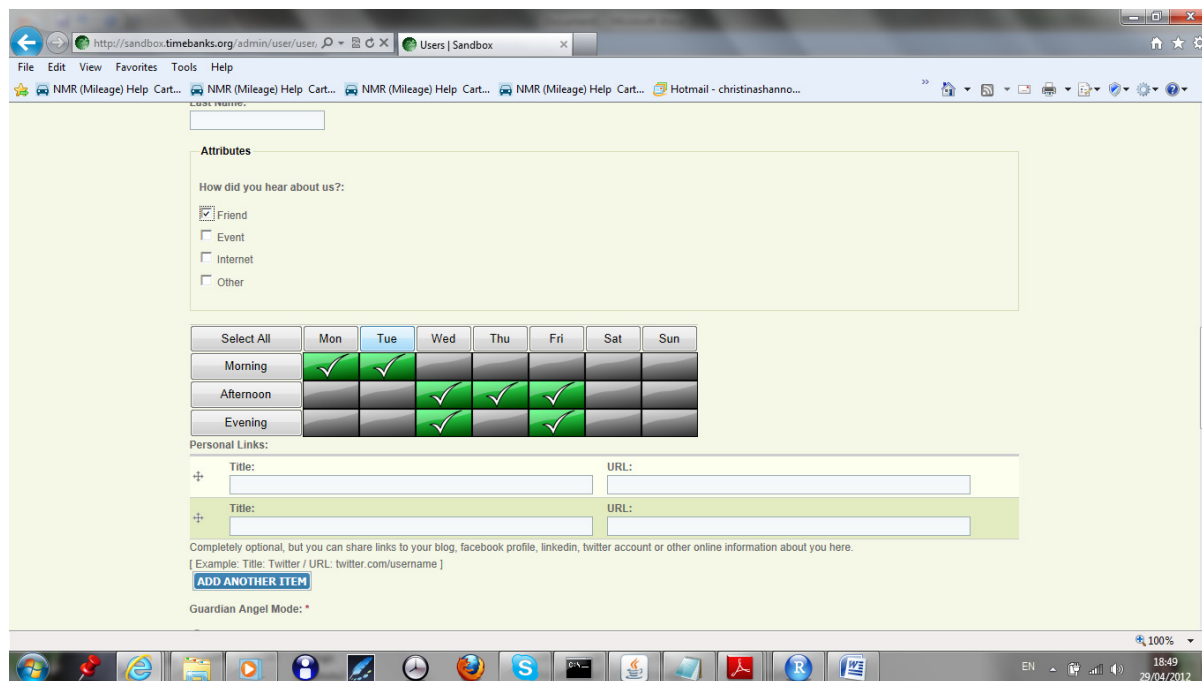
Sample of screen advertising an event



Sample of a list of all current requests for skills



Users account balance – what hours he has earned, and what hours he has spent



Screen indicating the participant's availability to carry out services offered

EXPERTISE 2 GO

One of the most prevalent topics that arose in our knowledge acquisition and was further highlighted by our analysis, was the subject of volunteers. Lifeline is a community-based project and therefore volunteers and participation are core elements of the project essential not only to ensure its survival and continuation but to its effectiveness as a project. Following our reviews of the available literature on Lifeline, the Lifeline website itself and meetings with Kaethe, it became evident that one of the Lifeline project's biggest challenges lay in getting the community involved. Due to the wide scope of the project and the fact that much of the information behind each project concept is tacit knowledge belonging to Kaethe, it became apparent that the process of getting involved was not well defined for potential participants. If Lifeline is to engage the whole community and continue to grow, it needs to draw participation and skills from the community. In order to do this on a scale large enough to elevate Lifeline from being one person's tacit knowledge, to a large-scale community run project, it needs to automate the process of getting people involved by directing them to information about the projects most suitable to them with instructions on how to get involved.

Our solution to this problem is to create a rule-based expert system using *Expertise2go* (<http://www.expertise2go.com/webesie/>) that could be integrated into the website of the Lifeline project. This system would act as an advisor directing potential volunteers to the area of the project most suitable to them. Our knowledge acquisition had enabled us to obtain the relevant information about the project from a domain expert (Kaethe), the concept mapping afforded us an overview of the whole project area and this was used as a basis to model the knowledge into a form suitable for use by an expert system. The project domain was assessed and we determined that to use an expert system was a suitable and appropriate solution. The evaluation of the project area justified the use of a rule-based expert system, (an advisor) for the following reasons:

- Rules can be used to represent knowledge formally in the expert system. These rules are appropriate for expressing knowledge characterized by situations with corresponding action, which is the type of knowledge we are dealing with.
- The task of advising is essentially rule based and procedural, with the knowledge being declarative in nature, making a rule based expert system a relevant solution.
- The inference strategy of forward chaining was selected since our advisor has numerous solutions. The very nature of the advisor is procedural, with the solution being reached incrementally. This allowed for the application of forward chaining.
- The expert system is modular with each rule representing an individual part of the knowledge. Therefore if a new rule is added the existing rules may not be affected. This is suitable for Lifeline, as the project will continue to grow creating the need for new rules and goals to be added to the system.

- The advising task is verbally oriented and therefore lends itself well to an expert system.
- The web-based implementation would also enable the co-ordination of the supporting content (the expert knowledge) with an inference process. This would be needed to direct volunteers. This would also allow for the individual project information to be displayed since a project selection advisor narrows in on a specific project appropriate to the user.
- The goal-oriented nature of an expert system would enable the system to produce the recommendations deduced from a very specific set of questions which represent the goals of the questionnaire.
- Efficiency was another key element in the decision. Since the expert system asks users for information based on the outcome of previous requests, users don't waste time inputting irrelevant information.
- This is especially important in retaining users on the site. The system also offers efficiency in terms of the expert's time. If a user does reach the stage of contacting Lifeline and get involved, they have already been directed to the project most suitable to them. Therefore they have information on the project and it does not have to be explained to them again.

In summary, the advisor would act as an entry point for users to the Lifeline web site; it is an active engagement point for potential project participants. This would encourage participation by making the process of getting involved transparent and easy to do. It also retains users on the site as they are actively involved. It is important to understand the knowledge seeking needs of our audience. Good information architecture design understands users needs and directs them to the information they require. (O'Reilly 2002)

Mapping of mechanism characteristics to problem domain characteristics

The concept map was developed from the analysis of our knowledge acquisition. This gave us a complete overview of the lifeline project. From this we were able to ascertain the key areas of Lifeline that would lend them to volunteer participation.



Table 9: Key projects for volunteer participation

The next step in the process was to envisage the real life situation of how the expert (Kaethe) would provide advice to potential participants that would result in directing them to a project suitable to them. Step one was to define the projects, which would be the subject of the final advice. The concept map and key areas outlined (above) assisted in determining the projects. Then the set of facts that would lead the expert to provide the value of each goal attribute were mapped. Finally the procedural steps that would lead a volunteer from start to finish were mapped out using a decision tree. The tree was compiled with the idea of being as open as possible to volunteers and endeavored not to alienate people who may be lacking skills or experience in the project areas. Lifeline encourages community participation at any level and we designed the advisor with that concept in mind. It also allows for those who are unsure of volunteering or may prefer human interaction by offering the opportunity to contact the expert. Interest and enthusiasm for the projects is the key pre-requisite for involvement. This is reflected in the second question where the user is asked to define their area of interest. The end result should fall within their area of interest in order for the project to be suitable for them.

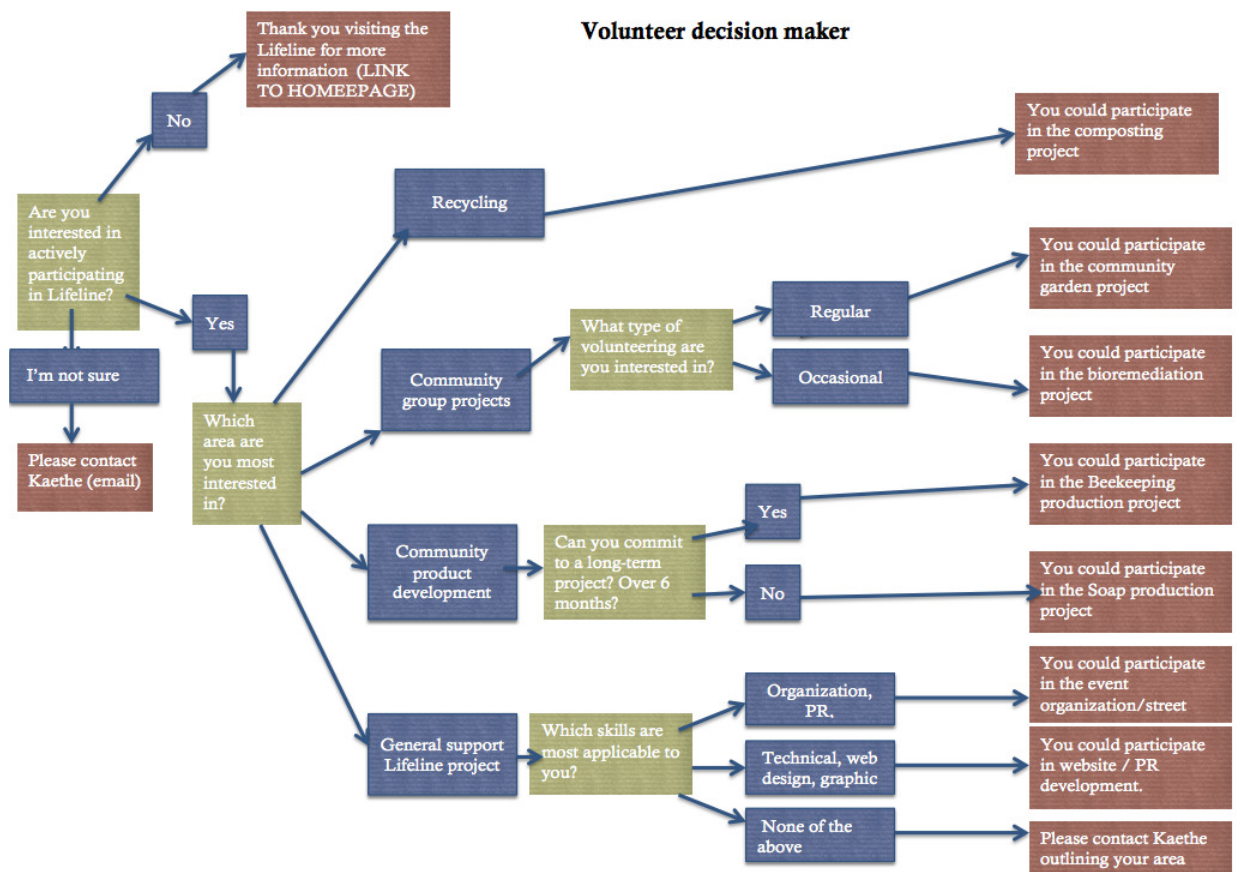


Table 10: Concept tree of advising process

The Rule based system allows us to infer if one condition or more conditions are met than a recommendation can be made, it is suitable to use for the project advisor as the inference centers around the premise a "Rule" with an "If" a condition, that when stratified produces a "Then". This is outlined in the examples from the decision table rule generator from our system below:

RULE [What type of volunteering are you interested?]

If [Getting Involved] = "Yes, I am interested in getting involved" and

[Area of interest] = "Community Group Projects" and

[Type of Volunteering] = "Occasionally"

Then [The Recommendation] = "You could participate in the Bioremediation project"

RULE [Are you interested in a getting involved in the Lifeline Project?]

If [Getting Involved] = "Yes, I am interested in getting involved" and

[Area of interest] = "Community Group Projects" and

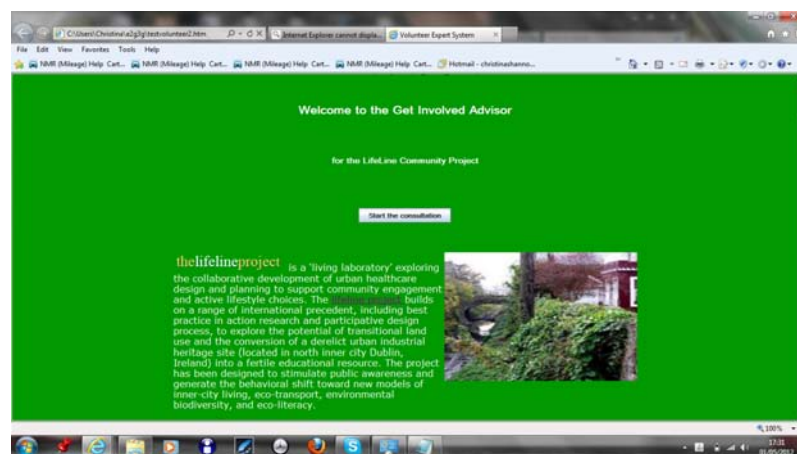
[Type of Volunteering] = "On a regular basis"

Then [The Recommendation] = "You could participate in the community garden project"

SAMPLE PATH THROUGH EXPERT SYSTEM

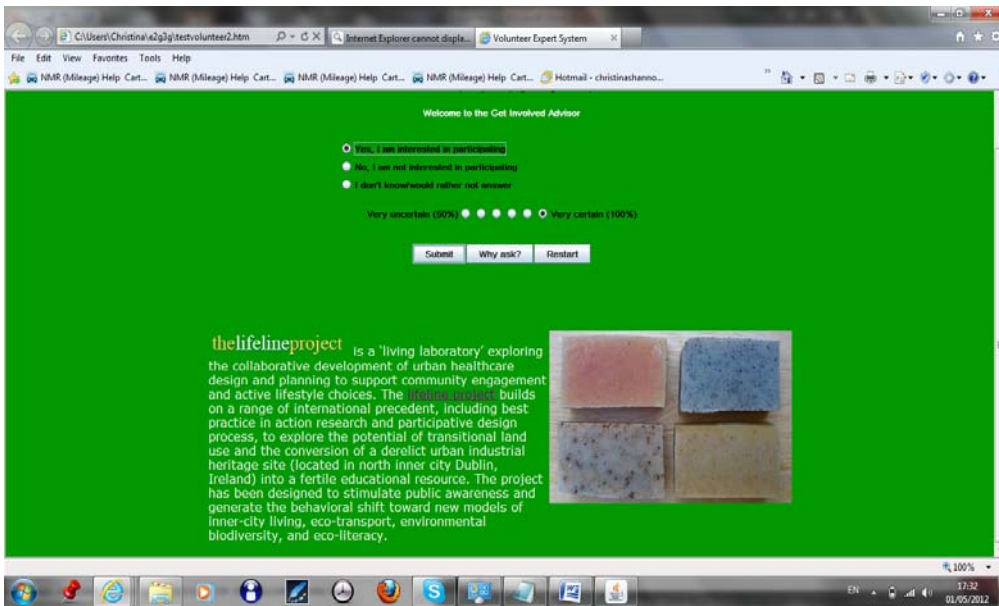
There follow screen dumps from our rule based *Expertise to Go Expert System* we have called **Get Involved Advisor**. This is for users trying to determine what particular area within the Lifeline community project to which they would like to contribute.

There are several paths to take. Below is a sample of screen shots, taking one particular path. Each step is dependent on the previous step.

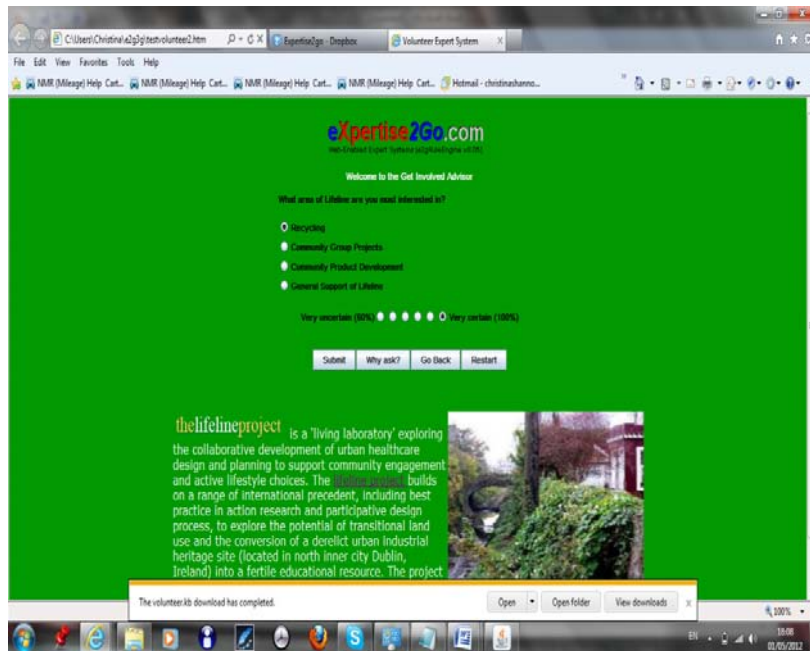


Home Page – Landing page

The User is asked ‘Do you wish to participate?’ and to what degree are they certain that they do? Options range from “50% Very Uncertain” to “100% Very Certain” with four other percentage choices in between.

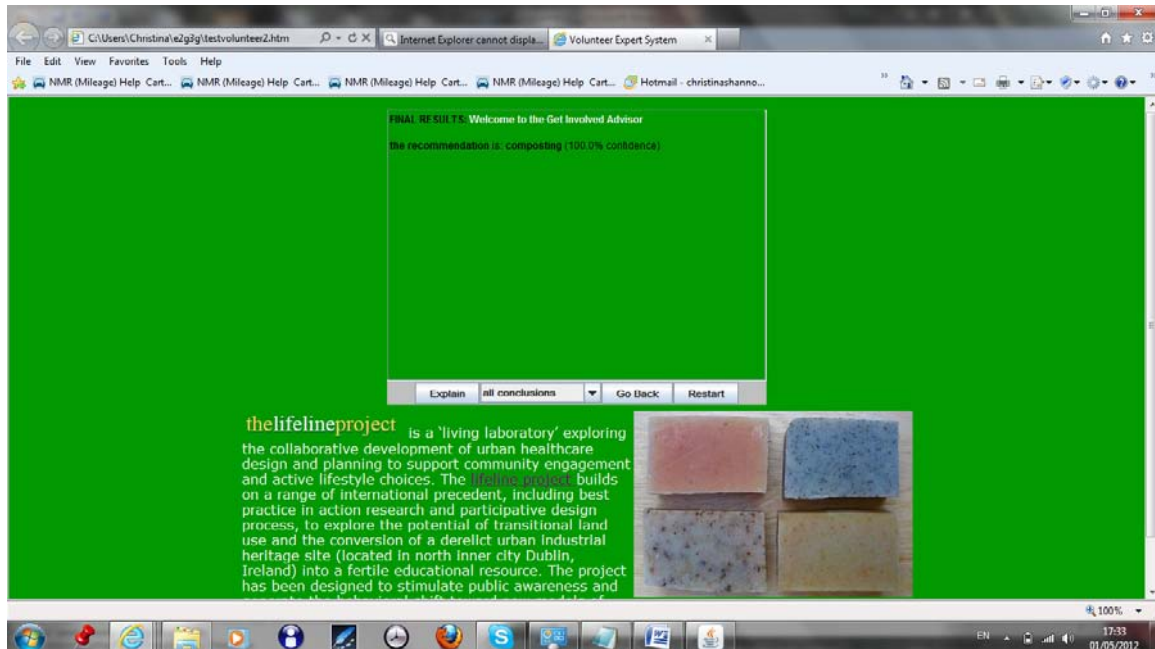


The user is then directed to a screen from which they can choose in which area they are interested.



The User has a choice between “Recycling”, “Community Group Projects”, “Development of Lifeline” (i.e.. web design, PR), or “I don’t know”.

If they choose recycling, the system prompts that ‘**composting**’ is the recommendation.



Recommendation screen

Similarly, if the user chooses product development, and chooses less than 6 months (time available to contribute) the recommendation is soap making, if the user chooses more than 6 months they are recommended bee-keeping.

In conclusion, it is hoped all these outputs will lead to: a tool (or tools) to schedule effective participation in the Lifeline project which will generate awareness, interest and understanding of the Lifeline project.