

eGanges and financial spaghetti: freedom and security

Pamela N. Gray,
Law Lecturer, Faculty of Commerce,
Charles Sturt University,
Bathurst, NSW, 2795

pgray@csu.edu.au

Xenogene Gray,
Computational Physicist,
Grays Knowledge Engineering
www.grayske.com

xen@grayske.com

ABSTRACT

Financial service providers need maps of the alternative legal dealings that are available in the organisation of financial transactions. These maps should provide information on when it is appropriate to use available alternatives. Each variation provides for something different, allowing for the sharing of profits, risks and losses in a great diversity of intricate relationships in a network of people. The network, which can now be wholly or partly created and modified, with speed, online, can be represented by the metaphor of spaghetti, as it may be knotted, so that it is difficult to unravel. Netting its multi-party consequences involves qualitative as well as quantitative and time factors. The spaghetti nature may provide industry security. It is the conscious design of the spaghetti security in a portfolio range, that becomes possible when there are appropriate maps for informed decisionmaking about appropriate financial transactions in given circumstances. The spaghetti network is underpinned by the freedom to contract and deal in various negotiable instruments, and constrained by prudential supervision and other regulation of the finance industry.

The relevant law and industry descriptions and heuristics can be captured seamlessly in the Rule/Procedure/Strategy maps of an eGanges application. eGanges is a new generation expert system shell that can provide efficient, interactive visualisation of rules, procedures and strategies as maps. This is demonstrated in existing applications, in commercial fields as well as a small experimental teaching map in the area of finance law.

Apart from being an advisory aid, an eGanges map may be used to train industry workers in complex jobs, so that more skilled workers can be readily available and trustworthy. The duties of care imposed by law are made less onerous.

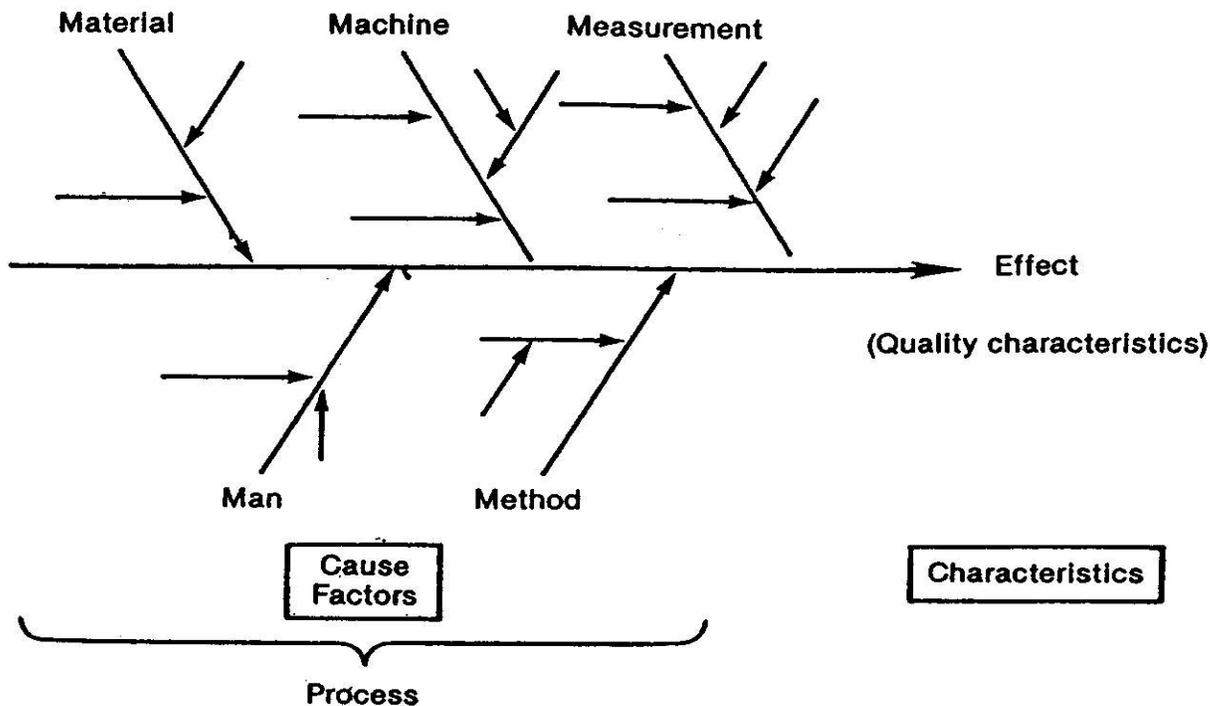
Further, eGanges maps are easy to construct and update, so that the Never ending Journey of reeducation in the field of Financial Service can be made with the latest revised applications. Like books, eGanges applications are themselves intellectual property, valuable capital and profit-making assets for the industry.

Introduction

The law provides for many different types of financial transactions and a range of transactional freedom. Legal categories of transactions allow for secured and unsecured loans and investments, greater or lesser risk, and greater or lesser profit. Some transactions are now called products and some involve the provision of financial services. Transactional decision-making requires both quantitative and qualitative assessment. All of this takes place at a time when electronic payment systems and electronic multi-lateral netting have displaced legal tender. Practical flexibility and electronic speed calls for appropriate new aids for the finance industry. eGanges, a new generation, user-friendly expert system shell, has been developed to streamline legal flexibility for faster, more effective transactional decision-making.

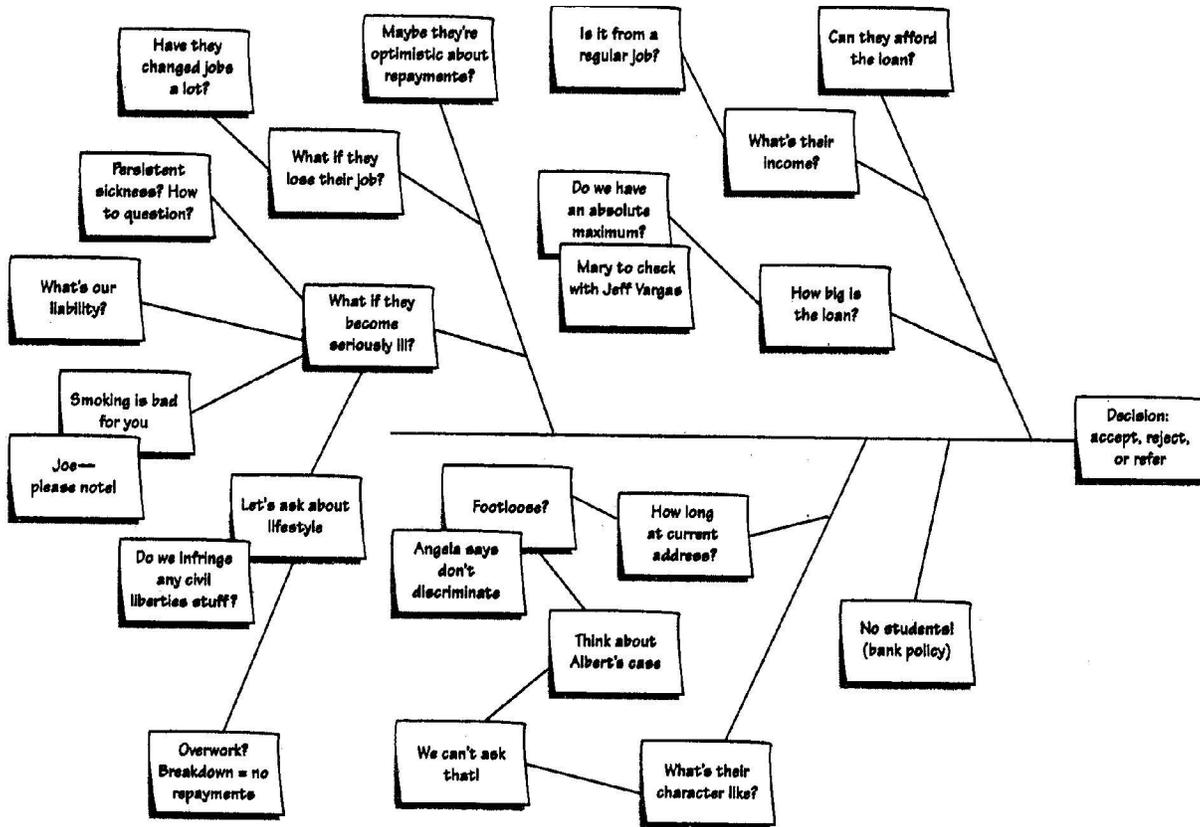
eGanges epistemology – knowledge structures

The way that eGanges (electronic, **G**lossed, **a**dversarial, **n**ested, **g**raphical expert system) provides decision-making assistance is through its epistemology, that is, through its simulation of qualitative reasoning. The finance industry has traditionally been supported primarily by quantitative reasoning. However, increasingly, it requires qualitative reasoning. As computer technology has reduced the labour of quantitative reasoning, there is now an opportunity to focus on qualitative reasoning. With the advent of electronic credit, qualitative reasoning takes on greater significance in financial decision-making.



Ishikawa (1985) Fishbone: Cause and Effect Diagram

Figure 1



Discovering Business Rules

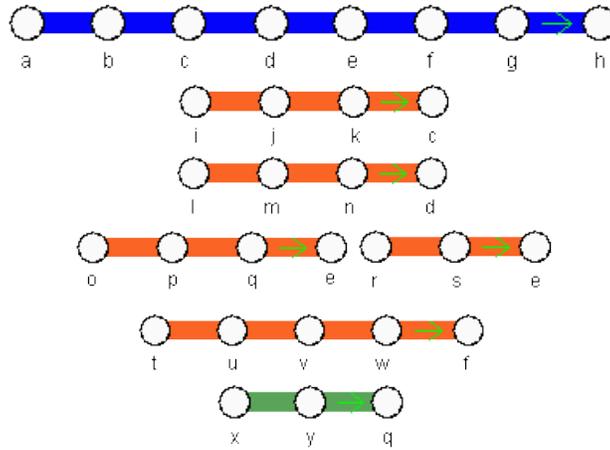
Morgan, T., (2002): *Business Rules and Information Systems*, Ishikawa Fishbone

Figure 2

The epistemology of the eGanges program was designed to capture legal epistemology. However, in the course of developing the program, it was seen that legal epistemology used a paradigm that was similar to the fishbone representation used in quality control management (Ishikawa, 1985). Ishikawa initially developed the fishbone diagram during the post second world war period in Japan, as the scheme for managing causal factors in manufacturing processes. Figure 1 is an Ishikawa fishbone. Figure 2 is an elaborate Ishikawa fishbone developed by Morgan (2002), to represent the business rules in loan decision making.

The eGanges equivalent of the Ishikawa fishbone is called a River system, as it is a tributary structure. Furthermore, eGanges allows nesting of River systems in sub-maps so that the River can be as extensive and complex as required by the expert knowledge. Rivers can represent causal systems, rule systems, procedural systems, strategic systems, or some combination of these system attributes as a mixed system. eGanges applications may be constructed for the finance industry wherever finance expertise uses a River paradigm in its qualitative reasoning. A River paradigm occurs where there is a system of rules, procedures, strategies or causes with overlaps such as those in Figure 3. When locked

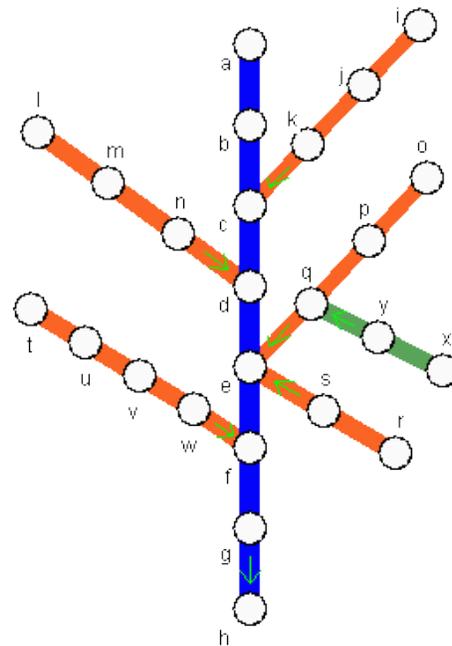
together at the common points, the tributary structure emerges, as shown in Figure 4. Once expert ontologies are formalised according to this rule paradigm, an eGanges application River is easy to draw. Ontologies are collections of concepts or semantic units, used in the expertise; they may assume existences or amount to social constructs that are part of the reality of social organisation.



Wholly formalised rule streams

Figure 3

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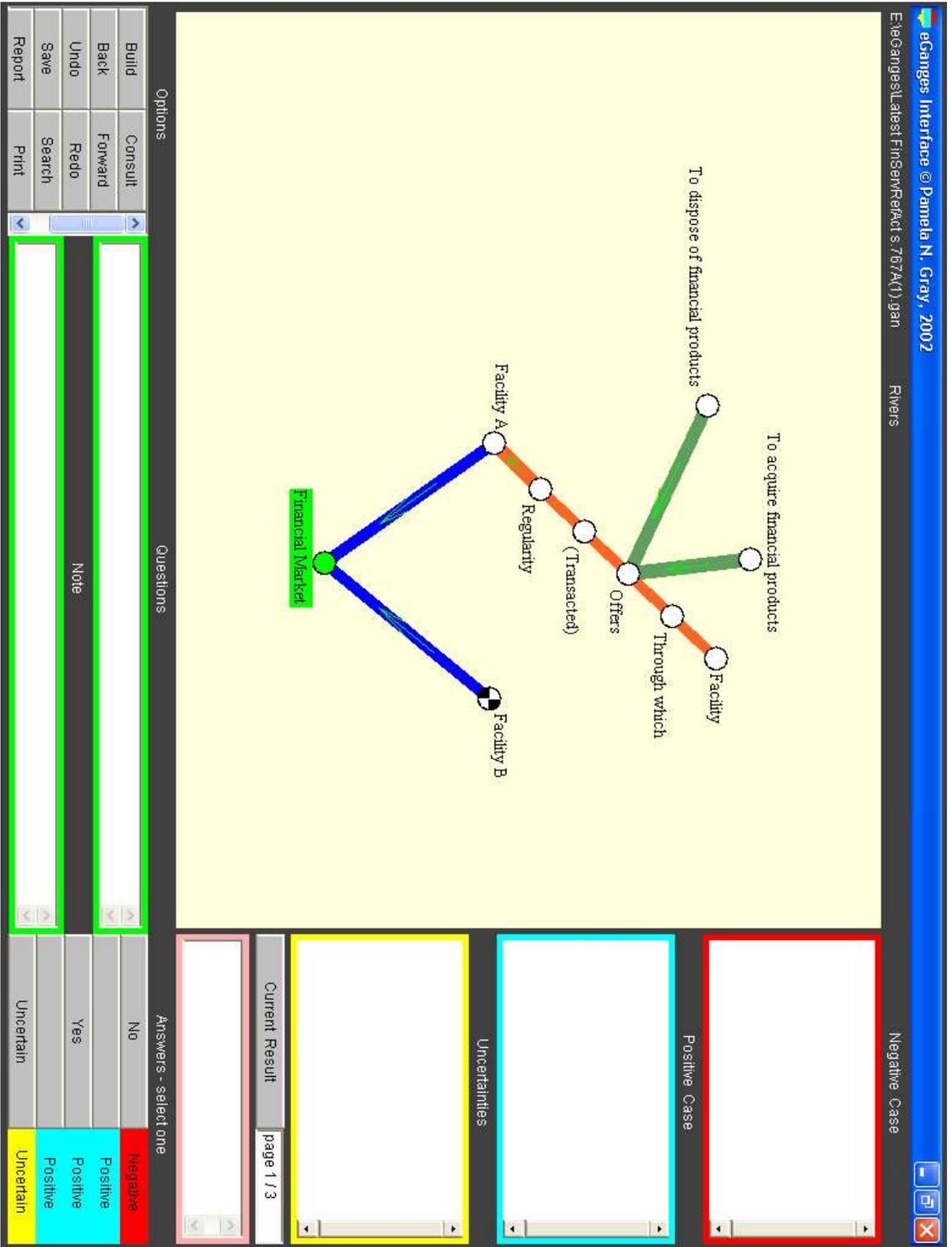


eGanges river map

Figure 4

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For instance, an eGanges River map of the system of rules in the Australian Financial Services Reform Act 2001 s.767A(1), is represented in Figures 5-7. Figure 6 is the nested map of the node, Facility B, in Figure 5, and Figure 7 is the nested map of the node, (Transacted), in Figure 6. The flow of the River system is indicated by arrows.



Financial Services Reform Act 2001 s.767A(1): Initial map in eGanges Rivers window

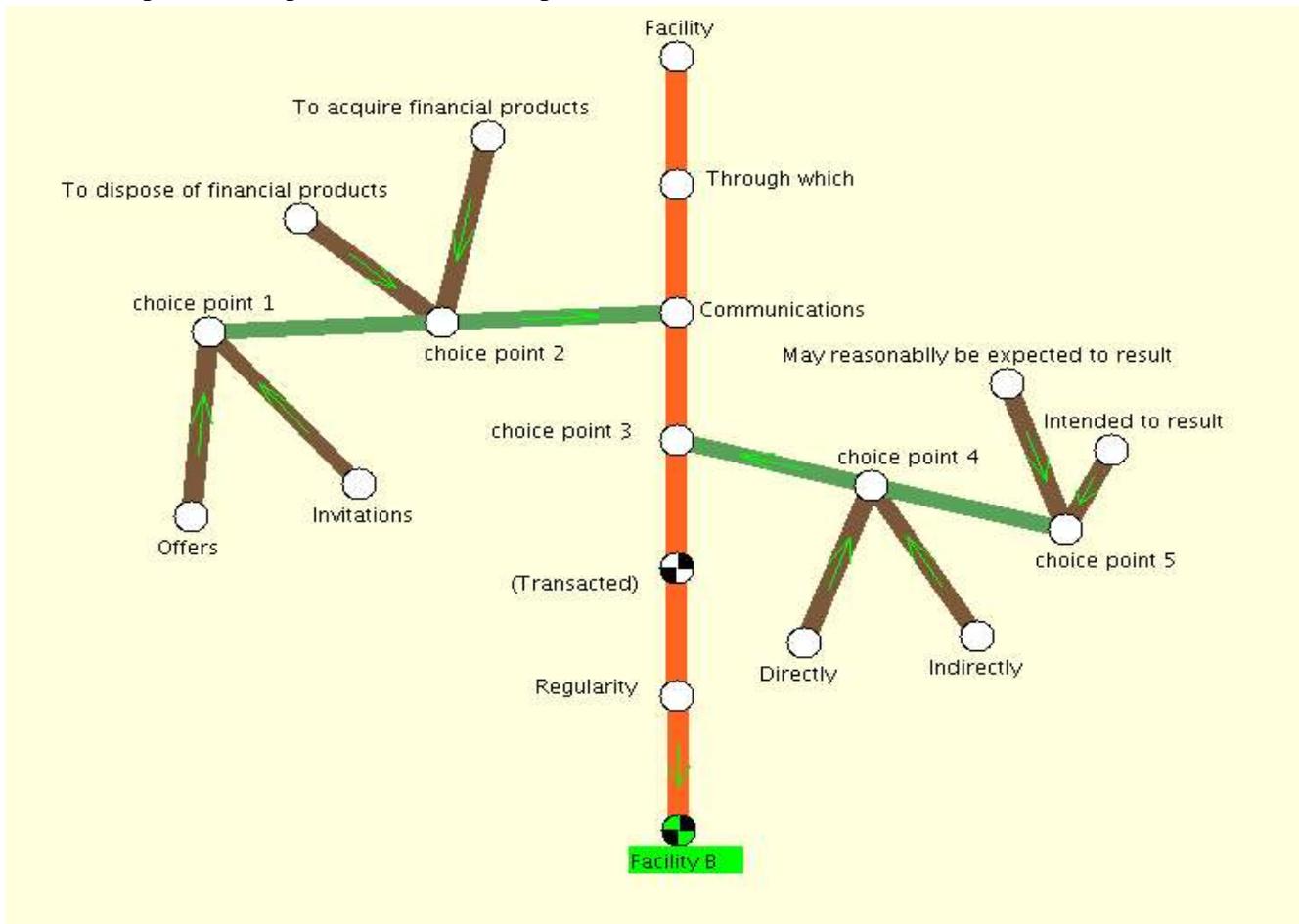
Figure 5

The Financial Services Reform Act 2001 s.767A(1) states:

For the purposes of this Chapter, a financial market is a facility through which:

- (a) offers to acquire or dispose of financial products are regularly made or accepted; or
- (b) offers or invitations are regularly made to acquire or dispose of financial products that are intended to result or may reasonably be expected to result, directly or indirectly, in:
 - (i) the making of offers to acquire or dispose of financial products; or
 - (ii) the acceptance of such offers.

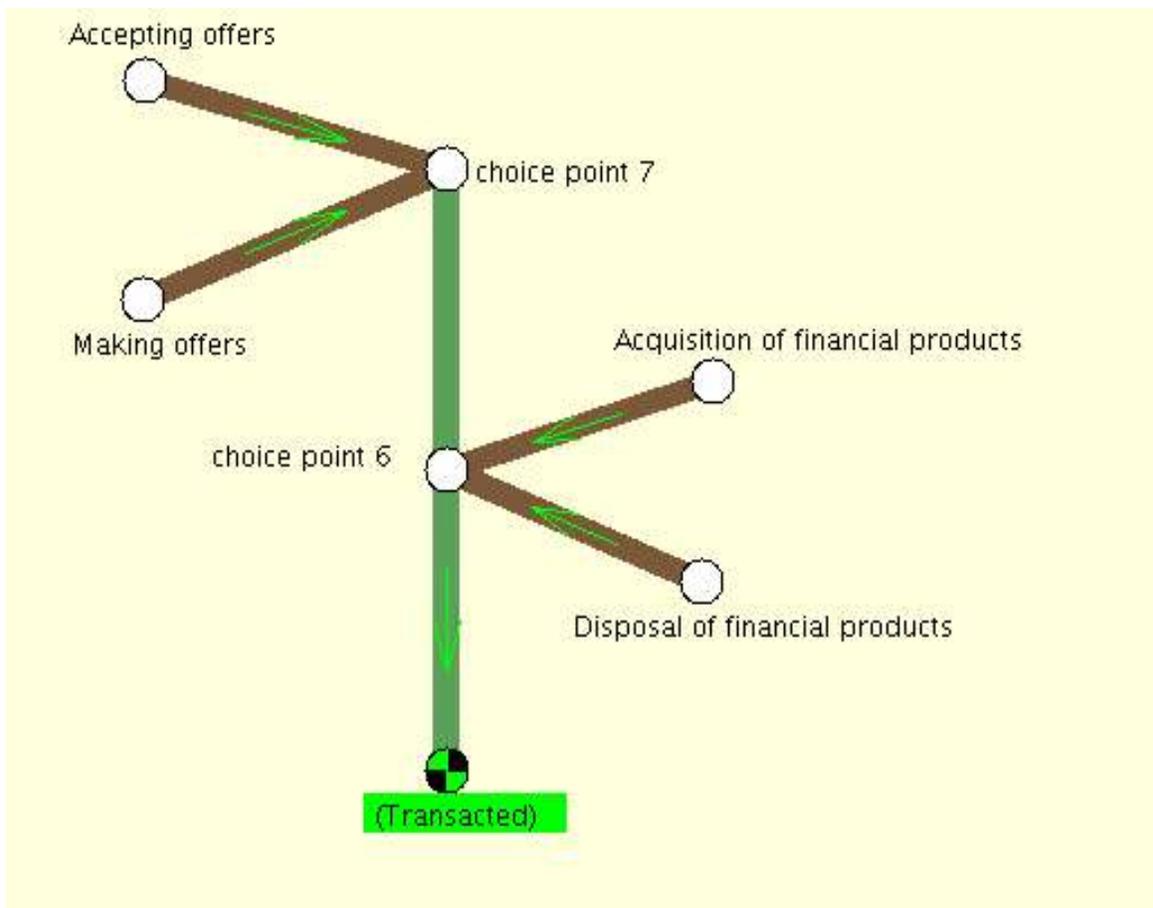
The heuristics of finance experts may be added seamlessly to extend rule systems of law, such as the law in Figures 5-7, so that the practical details of transactions arise from, are managed, and remain within the law; at the same time the scope of legal freedoms, with the precise points of choice can be evaluated within the system of legal choices, as extended by the system of practical choices. The exercise of building a finance application may require the melding of several different expertises, to produce a more comprehensive aid.



Financial Services Reform Act 2001 s.767A(1) submap: Facility B

Figure 6

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Financial Services Reform Act 2001 s.767A(1) submap: Transacted

Figure 7

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A law and practice integrated system might indicate how the finance industry can take better advantage of legal choices and how it might create new rules of law through the law that fosters innovations in financial transactions. The law that fosters commercial innovation was explained by Bigham J. in *Edelstein v Schuler & Co* [1902] 2 KB 144, 154-5 as the reliance of common law on custom:

... in determining whether a usage has become so well established as to be binding on the courts of law, the length of time during which the usage has existed is an important circumstance to take into consideration; but it is to be remembered that in these days usage is established much more quickly than it was in days gone by; more depends upon the number of the transactions which help to create it than on the time over which the transactions are spread.... the law merchant is not fixed and stereotyped... it is...capable of being expanded and enlarged so as to meet the wants and requirements of trade in the varying circumstances of commerce.

To assist evaluation of a River system, eGanges permits annotations or commentaries on any node; it has menus for adding various types of glosses. For instance, the node, Facility A, may have a text gloss that contains a description of the historical origins of the Market A type, and the identity of contemporary Market As; as well there may be

suggestions for new Market A identities. Any node may have as many different text glosses as required. Other available glosses, apart from the text gloss are as follows.

- Intra-river links that allow a link between two nodes in the same River system
- Parallel River links that allow links between two nodes in different River systems
- Links to any other file, database, program or website

It is to be noted that the River represents conjunction and disjunction in different structures: a straight river with several nodes indicates the conjunction of those nodes. Where straight rivers with one or more nodes share a common consequent, there is a fan structure that represents disjunction. Thus there are two ways of establishing a Financial market: by establishing Facility A or Facility B. eGanges provides choice point numbering where a label is not otherwise available. Fans produce alternative pathways for reaching the Final result of the River. When these alternative pathways share some common nodes, they can be understood as alternative overlapping pathways.

eGanges epistemology – knowledge processing structures

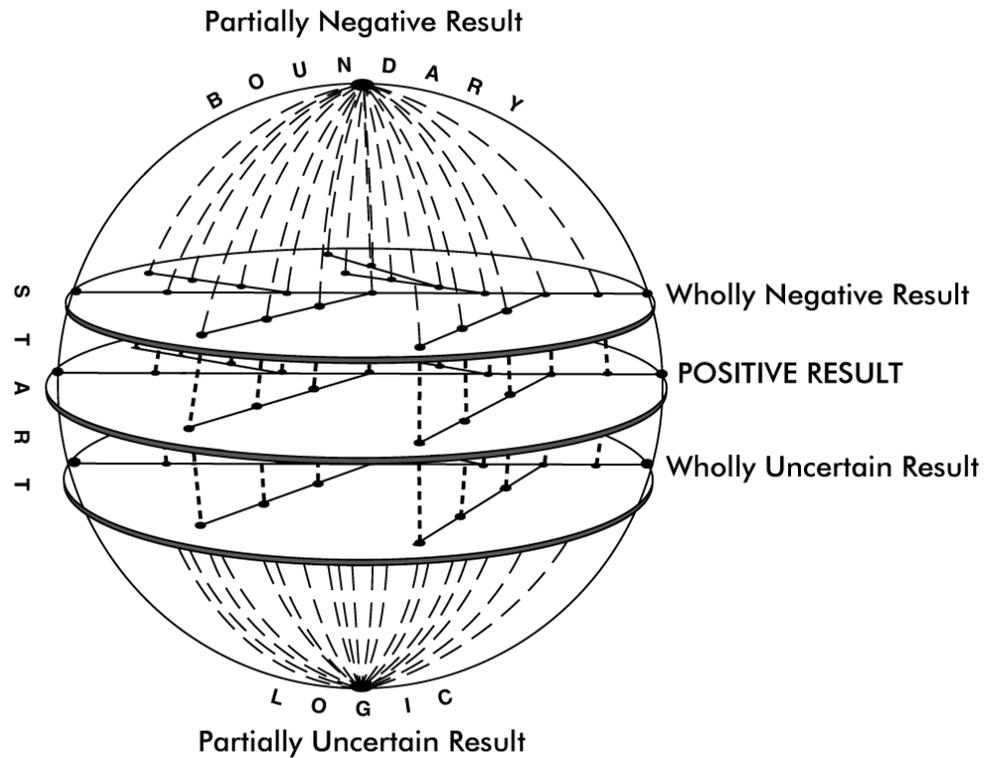
The adversarial nature of qualitative reasoning requires logic that accommodates the contradictory tributary structure and the uncertain tributary structure. In the corresponding contradictory River, that is the Negative river, all the nodes contain the concepts that are contradictory to the concepts of the Positive river; likewise, the Uncertain river contains the uncertain concepts that correspond to the concepts of the Positive river. For example, the contradictory of the node, Disposal of financial products is No disposal of financial products, and its corresponding uncertain node is Uncertain disposal of financial products. Node labels are the antecedents of the River rules and these antecedents are established through the node questions.

Thus, a question might be asked to establish whether or not there has been disposal of financial products: Has there been disposal of financial products? The answer 'Yes' will be placed on the central Positive answer button, the answer 'No' will be placed on the Negative answer button, and the answer 'Uncertain' will be placed on the Uncertain answer button. Answers are positioned on the answer buttons according to the sense of the natural language question, so that the Positive answer, be it 'Yes' or 'No', supports the Positive Final result or the Positive case, the Negative answer, be it 'Yes' or 'No', supports the Negative case, and the Uncertain answer supports an Uncertain Final result. *Pro tem* or Final results may be obtained at any time during a consultation by pressing the Current result button; the current result is then displayed in the Current result window.

The full set of rules are not shown in the Rivers window, but are presupposed in the knowledge processing structures and functionality of eGanges. Their visualisation requires the spherical imaging shown in Figure 8; three dimensional graphics are cognitively disorienting and less useful than a two dimensional structure that captures the three dimensional significance. However, Figure 8 shows that the failure of any Positive requirement due to its contradictory, establishes the Final negative result; likewise the failure of any Positive requirement due to its uncertainty, establishes the Final uncertain result. A negative point overrides an uncertain point in the netting of the Final result.

The knowledge processing structures of eGanges can be seen in its interface, shown in Figure 5: the Question window, the five answer buttons, the three adversarial windows (Negative case, Positive case and Uncertainties) and the Current result button and window. Three Positive answer buttons are available so that all three possible answers may be placed on them where there are no Negative and Uncertain effects of the answers; these are called neutral nodeas. The Note window can be used to give output advice on the Question and to receive user input about the answer, such as

evidentiary detail that supports the answer given.



eGanges river map

Figure 8

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eGanges epistemology – DIA lectic and functionality

Qualitative reasoning uses the three forms of logic: deduction, induction and abduction. Deduction is necessarily correct; induction may be necessarily correct, and abduction has a range of validity from strong to weak arguments. eGanges partitions the premises available for each type of logic, and carries out extended deductive argumentation processes.

The River structure represents the Major deductive premises. Inductive and abductive premises can be made available in relation to any node through the gloss facilities. It is appropriate to use a spectrum gloss to iterate the range of items that constitute the negative sector, the positive sector and the uncertain sector in the inductive range. Some of these items may warrant an argument by analogy as well as authority or common sense. A spectrum may assist a user in answering a question to establish an antecedent node in the River. In response to Questions for each node that appear in the Question window, an answer may be selected from the three available answers on the answer buttons. The user can see before the selection of an answer, what answer will support the Negative case and what answer will support the

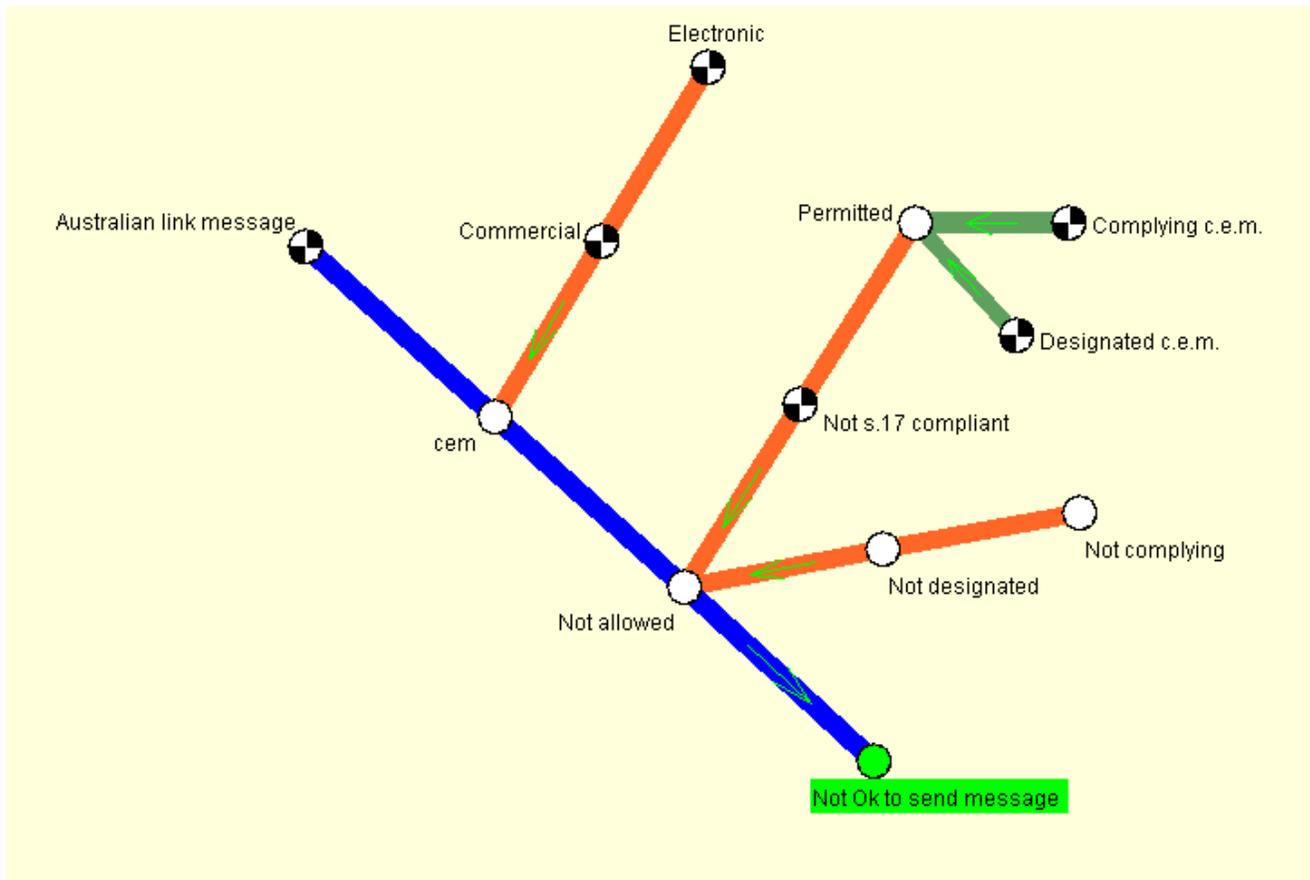
Positive case. Input answers are sorted into the appropriate adversarial window; they become the Minor premises for the extended deductive argument.

The River premises can be understood as alternative overlapping sets of necessary and sufficient conditions to establish the Final positive result. Each river in the tributary structure is a major premise that contains necessary and sufficient conditions. Minor premises (answers) indicate which conditions are applicable. However the overall assessment of overlapping alternative possible sets of necessary and sufficient conditions, requires advances in meta-logic that have been developed for eGanges. These advances enhance the formalisation for automation of qualitative reasoning, especially in the provisions for alternative future possibilities.

eGanges advances in logic

The functionality of eGanges includes the following advances in logic processing:

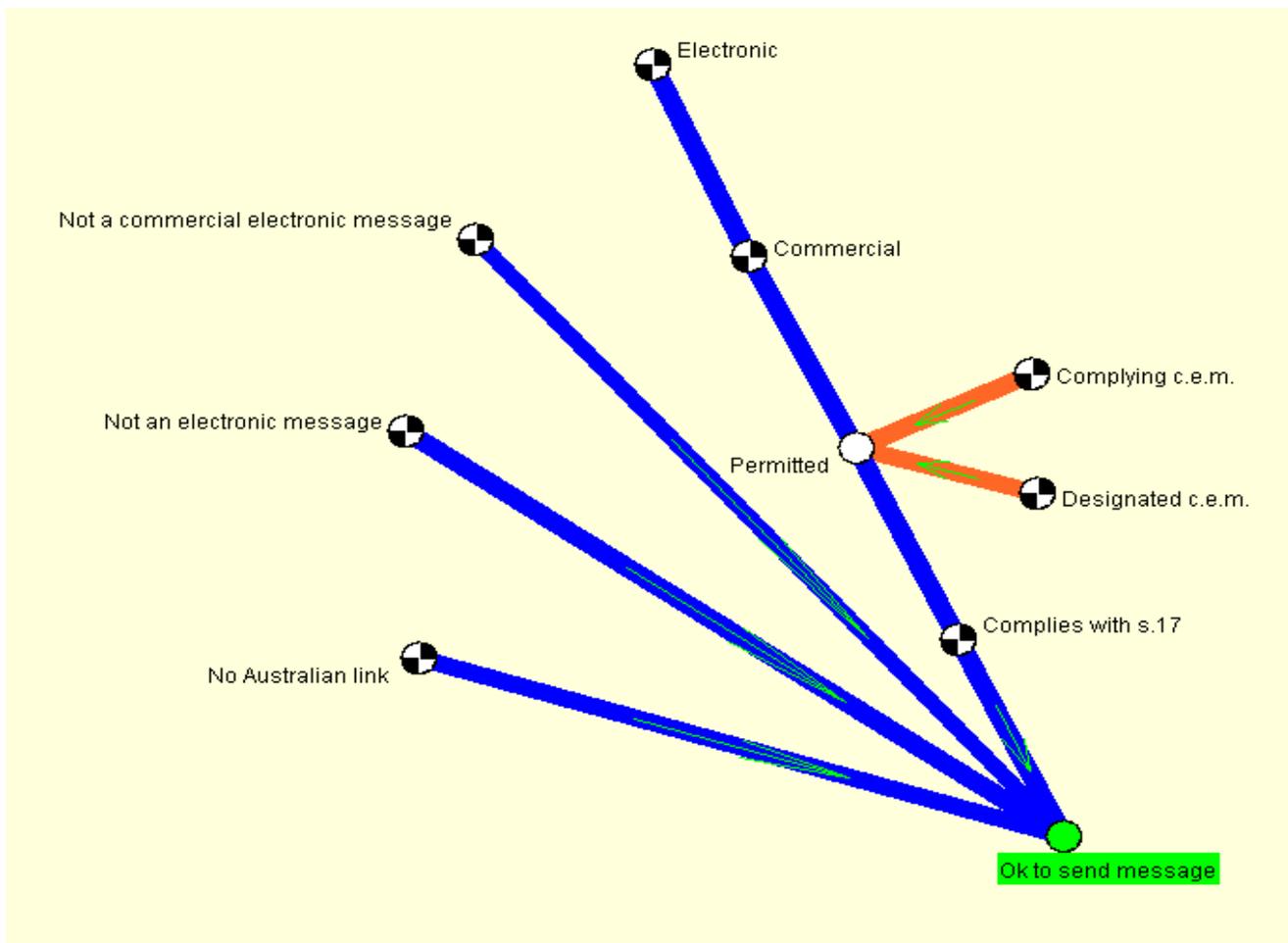
1. Processing alternative overlapping sets of necessary and sufficient conditions; logic has been limited by its current use of material implication (if and only if propositions) that do not handle alternatives and their overlapping;
2. Suspended negatives/uncertains to handle alternatives (disjunctions); until all alternatives are exhausted, a Negative answer is treated as part of the Positive case profile. eGanges indicates a suspended Negative in the Positive case window by the addition of (Neg) in front of the node label. Suspended Uncertains are treated similarly in the Positive case window with (Unc) in front of the label. When all the streams in the fan fail, the suspended Negatives and Uncertains are re-sorted into the appropriate adversarial windows;
3. Automated upgrading of hierarchical logic of extended deductive argument to prevent inconsistency; this adjusts consequent nodes to keep their consistency with their antecedent nodes. For example, where an interim consequent has been answered Uncertain and subsequently its antecedents are answered Positive, then the consequent node is automatically changed from Uncertain to Positive.
4. Automated domino inferencing of extended deductive argument; this implements indirect inferencing from deeply nested maps to the Initial map.
5. Handles contradictories of all and some by suspended negatives/uncertains. For example, Figures 9 and 10 are the Initial maps in contradictory applications of the Australian federal Spam Act 2004: Figure 9 has the Final result of 'Not OK to send message' and Figure 10, produced with Philip Argy, senior partner of law firm Mallesons Stephen Jaques, has the Final result 'OK to send message'. The two maps reflect the irregularities of contradictory categories that can be contained in law.



Spam Act 2004 Initial map – Not OK to send message

Figure 9

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Spam Act 2004 Initial map – OK to send message

Figure 10

Portfolios

A portfolio of financial products might include any one or more of the following: shares, debentures, mortgages and charges, guarantees, indemnities, bonds, futures, derivatives, options, securitisation contracts and negotiable instruments. The categories are not closed and the law acknowledges the creative freedom of financiers; it will recognize customary practices of the finance industry. Each of the available transactions may have a selection of terms chosen from a range of variables; *prima facie* the amounts of the benefits and the extent of the risks are determinable by agreement between the parties. Where negotiable instruments once obviated the need for cash, they now do so electronically. The holder of an investment portfolio may deal in a great variety of ways with various people from time to time. Transactions may be wrapped in other transactions. The portfolio starts to look like a variegated entity. Where portfolios are managed, they may be wrapped in service contracts.

Transactional spaghetti

Portfolios of a group of investors are managed individually, and may be managed collectively. Where different financial transactions are made between members of the same group, the collective management may produce designed results or inadvertent transactional spaghetti.

Spaghetti transactions may disguise net relationships and they may secure relationships. Circumstances for receiving benefits, and for realization of risks, are qualitatively variable according to the nature of the financial transaction and the arrangements of the parties. This requires some knowledge of available variables and some creativity in construing the requirements of the parties to the nature of the available variables. An integrated law and practice Finance application of eGanges may assist intentional design and optimum arrangements.

How far a legal or practical link or spaghetti strand from one group cluster of portfolios extends into other group clusters of portfolios, and what legal relationships will be broken if parts of clusters are removed, may not be apparent. Modelling the spaghetti extensions, with their flow of potential profits, risks and losses, to portfolios outside the cluster requires the strands of legal or practical links to be understood more comprehensively.

Electronic spaghetti

Is it enough to rely on spaghetti intricacies to distribute wealth and risks, or should we be developing systematic controls over what has evolved by nous in the industry? It may be more important to develop scientific precision in an electronic economy. The speed and immaterial nature of the electronic finance industry is subject to prudential supervision. The Australian Prudential Regulation Authority must peer into individual clusters and their environment. If it sees a slippery spaghetti reforming continuously at lightning speed, it must use scientific precision at a corresponding speed to evaluate it. Practice heuristics need to be added seamlessly to the legal framework of the transactions.

For the Reserve Bank of Australia, management of the economy during the period of dominance of the legal tender payment system, required general monetary policy for the expansion or contraction of available cash. Since legal tender has been replaced by electronic multi-lateral netting as the prevailing bases for payment systems, macro-economic management must develop accordingly. The responsibility of the RBA now extends into the regulation of payment systems. The Australian Securities and Investment Commission, which has corporate regulation responsibilities and powers, now also has the task of qualitatively regulating financial service providers, in cooperation with other government agencies.

eGanges is an electronic qualitative reasoning aid that might assist in meeting the challenges of sustaining coherent decisionmaking in the electronic finance industry, to both secure and optimize its freedoms. Its applications are succinct enough for handheld advice on personal digital assistants; simple clicks permit navigation of the Rivers, access to gloss information, answer inputs and current conclusions. Notes can be recorded in the Notes window and consultations can be saved and printed out as a report.

Applications of eGanges, called eggs, are only as good as their authors. A basket of eggs may be required for portfolio management, prudential supervision and macro-economic determinations based on micro-economic patterns.

Conclusion – electronic qualitative assessment

Financial decisionmaking involves qualitative as well as quantitative assessment. Quantitative assessment methods are well founded. eGanges is a precise qualitative tool that can be linked as required to any quantitative or other qualitative program for seamless decisionmaking. It is designed to permit, in a user-friendly way, the categorization of qualitative premises which are used in the finance industry, as deductive, inductive and abductive premises. Its collection of user input as minor deductive premises, completes the available deductive premises to automate the extended deductive process so that there is a rich output of argument and assessment of a deductive conclusion.

eGanges may assist management of overlapping sets of necessary and sufficient conditions for the realization or achievement of a goal. In its deductive River hierarchy, choices may be assessed for selection. Its applications may streamline and nest complexity. Risk evaluation may be systematized through its list of input uncertainties in its Uncertainties adversarial window. and through its link glosses. Deeply nested eGanges maps allow more precise control over detail and indirect relationships; they may counter the chaos of the financial spaghetti range across the electronic landscape where society looks for the balance between control, security, understanding and freedom.

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