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Ethical Moments Within The Soft Information Systems & Technologies Methodology (SISTeM)

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ABSTRACT

Information Systems Development (ISD) covers a wide spectrum of methods and approaches (Avison et al. 2006), each aiming to make the process better and more successful. However, although ethics is seen as a core element with professional practice, it has yet to make an impact within the ISD process itself. This paper seeks to extend previous work, looking at the integration of the Ethical Grid (from Seedhouse 1991; Seedhouse 1998) into the three cycles of the Soft, Information Systems & Technologies Methodology (SISTeM). This is an attempt to integrate ethical thinking and considerations into the information systems development process.

Keywords

Ethics, Soft, Information Systems & Technologies Methodology (SISTeM), SSM, Ethical Grid, socio-technical.

INTRODUCTION

Information Systems Development (ISD) covers a wide spectrum of methods and approaches, from the structured to the 'soft', from the all encompassing to the very specific, and from a range of very differing backgrounds (Avison et al. 2006; Hirschheim et al. 1989). Increasingly ethics is seen as a core element within professional practice in the technology/information systems and computing field, 'As technology progresses and its application extends beyond the world of commerce into the public domain, supporting and changing lifestyles, it is crucial that prior understanding of potential ethical issues be gained' (Harris et al. 2008). This paper seeks to integrate ethical thinking and considerations into the information systems development process, thereby creating a more positive outcome for all involved.

The Soft, Information Systems & Technologies Methodology (SISTeM) (Atkinson 2000; Atkinson 2002) is a systemic approach to facilitating decisions, designs and deliverables for achieving informated socio-technical solutions in response to real world problems. It does this through harnessing the agency of humans and non-humans in order to make decisions, subsequently enact those decided-upon solutions. As with all forms of agency, in this case socio-technical, there is unavoidably an ethical component, whether or not this is overtly acknowledged. 'One could have done otherwise' (Fischer et al. 2007, p168), moral choices are made, whether explicit or implicit. The actions entailed in choosing and deploying the approach and, through its use, subsequently implementing real world socio-technical solutions to a specific IS related issue is an essentially ethical endeavor; whatever the underlying moral principles may be. SISTeM integrates Soft Systems Methodology (SSM) (Checkland 1981; Checkland 1990; Checkland et al. 2006) with the tools and techniques of information systems (IS) design and development; primarily UML. This socio-technical approach has been developed and deployed within healthcare settings in the UK and internationally; although in principle it could be deployed in any organizational or inter-organizational situation. One aspect of decision making by human actors within the methodology is that any solution which emanates from its application is 'ethically defensible'. Currently within the SISTeM approach there is no apriori prescription as to what those ethical grounds ought to be, or the tools and processes by which ethical consideration is given; only that it is transparent and open to scrutiny. As there are a number of tools and techniques associated with a majority of SISTeM activities, there are existing grounds for its ethical dimension also to be similarly facilitated by some tool or technique. It is this principled component of the SISTeM methodology and how it is embedded in the ensuing human/machine ('humanchine') solution(s) issuing from its deployment that is interesting. How ethicality in SISTeM may be facilitated through the deployment of a particular instrument, the 'Ethical Grid', is at the heart of this paper.

ETHICS AND IS

Ethics as a topic has a long philosophical history, arising from a significant theoretical basis. However, there is less which specifically relates ethics to IS, and still less which focuses on how practical support for ethical consideration could be drawn into IS development (ISD). While all would agree that it is essential for ethics to be considered within IS development, implementation and use, it is less clear exactly what type of ethics should be considered, and consequently how to do so.

There is a large body of research work that has looked at ethics (and morality) and IS, from a broad range of perspectives ((Albrechtslund 2007; Baase 2008; Banerjee et al. 1998; Bell et al. 2004; Brey 2000; Brigham et al. 2007; Moor 1985; Mumford 1981; Quinn 2006; Reynolds 2007; Smith 2002; Smith et al. 1999; Stahl 2005; Stahl 2008; Stahl et al. 2008; Tavani 2008; Tavani 2004); and journals such as Ethics and Information Technology). This explores many interesting issues; such as how ethics is used in a normative fashion (rather than descriptive) and when so applied has a political edge (Adam 2001). Or how IS ethics and computer ethics overlaps with business ethics, such that the stakeholder approach, shared values and norms and corporate social responsibility might raise awareness and help shape views on ICT ethical problems (Stahl 2008). However, this is problematic, as the business oriented approaches have a 'blind spot' in that their starting perspective is one of accepting the current socio-economic status quo. They lack the ability to question the implications of wider changes in society (eg. at the economic level) which might affect the use of information/IS, and so change the nature of the ethical scenarios being dealt with.

Much of the existing literature has focused on ethical and social issues in the use of computer-based systems as well as ethical guidance and advice for professionals in the field and for education of the future IS professionals (Tavani provides an extensive bibliography of this subject area, Tavani 2008 and http://cyberethics.cbi.msstate.edu/biblio/; (Couger 1989)). Another approach is encapsulated by 'value sensitive design', which looks to include in the technology development process "human values in a principled and systematic manner" (http://depts.washington.edu/vsdesign/). This has been translated into 'envisioning criteria', which draws attention to a) systemic interaction, b) multiple stakeholders, and c) value tensions, which have themselves been used within a context of scenario-based design to challenge existing conceptions of the impact of technology and bring in a wider perspective (Nathan et al. 2008). While this approach appears worthwhile, aiming to encourage designers to be responsible and to anticipate/consider the long term systemic effects of technology, and while it does have an implicit ethical element its broad focus is on societal impacts as well. Related work in the Computer Human Interaction (CHI) area on designing systems that support human values has also attempted to provide support for designers to recognize both their own values and those of the relevant stakeholders (Flanagan et al. 2008).

One study of interest proposed that given the use of IT in systems with potential societal impact (such as medicine) there should be an integration of some form of ethical analysis as part of the IS development process (Wood-Harper et al. 1996). They drew on Soft Systems Modeling (SSM) and stakeholder analysis to propose a 'series of steps' to be taken to construct a web of ethical perspectives. Therefore, while it is good for Wood-Harper et. al. (1996) to have called for the incorporation of an ethical dimension within soft socio-technical approaches to IS development, this approach remains rather philosophical (Taylor et al. 2002).

This paper is concerned with ethics in terms of the IS development process. While this is informed by the wider viewpoint of ethics within the use of computer-based technologies, and professional ethics and computer responsibility, these are not the core areas of concern. The argument is that there is still a need for more concrete developments in support for the practical use of ethical approaches 'in situ' within the IS development process itself. It is how, pragmatically, to go about the embedding of ethics in the socio-technical IS development process itself that is the focus here.

ETHICAL GRID: AN OVERVIEW

The Ethical Grid was developed as a means of helping doctors and other clinical practitioners to make overtly ethically grounded clinical decisions with respect to patients and their diseases (Seedhouse 2002). The Grid is intended to enable them to take into account a number of ethical positions as they go about their professional clinical decision making (Seedhouse 1991; Seedhouse 1998). The grid (see Figure 1) has four layers for ethical consideration when dealing with a patient. Layer 1 deals with external considerations: for example the risks entailed in not undertaking a specific clinical intervention, eg. failing to section someone under the Mental Health Act. Layer 2 is concerned with what is termed 'the good'; for example, the imperative to pursue "increased social good" as a result of specific forms of information being made available to specific classes of user. For example, letting a person's family know that one of their members is not carrying a specific gene that shortens life span or has a propensity to breast cancer; thereby increasing the good of an extended family. Layer 3 centers on 'oughts', what should be done under specific or universal circumstances, e.g. Kant's dictum "Act only on that maxim which you can at the same time will that it should become a universal law…" (L'Etang 1992, p742), for example, secure storage of patient's private clinical record. Layer 4 consists of the core concerns for clinical agency i.e. the patient or, here the person; have respect for them and their autonomy and equality. Also, the clinician ought to, serve their (clinical) needs before, purely, their wants. Note that the grid does not proscribe ethical agency rather it enables its users to ethically ground any future intentionality.

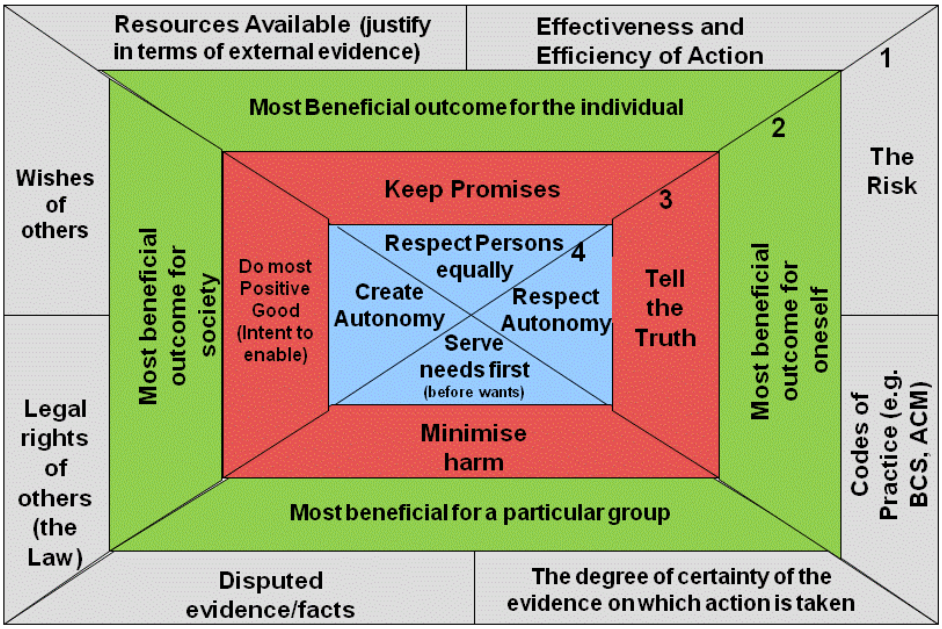

Figure 1. The Ethical Grid (Seedhouse 1998)

The Ethical Grid (Figure 1) consists of a series of concentric layers. These layers collectively constitute a landscape of moral reasoning that offers the potential to underpin real world informated socio-technical practices and the outcomes that result from its use. The Ethical Grid breaks down into four domains or layers of ethical analysis; here modified to accommodate information systems as agents alongside their human users. They are:

Grid Layer 1: "external considerations" to agency

Grid Layer 2: "consequences" of agency

Grid Layer 3: "deontological considerations" (oughts) for agency

Grid Layer 4: "core concerns" of agency

Considering each layer of Seedhouse' Ethical Grid in turn with respect to the SISTeM ethical socio-technical information systems practices:

- Layer 1, the outer layer, encompasses the "external considerations" which have to be taken into account when planning for, and executing, some form of agency; inthis context, those of any informated socio-technical practices within which the human/machine network is informated through the introduction of a new IS application.
- Layer 2, requires the consequences of our human and/or (information) technologies' actions in the performance of their tasks that have to be taken into consideration when developing, implementing and using the application in tandem with any human agency.
- Layer 3, encompasses deontological considerations; what "ought to" be accomplished through any form of informated "humanchine" agency issuing from informated sociotechnical interventions and practices.
- Layer 4, at the centre of the grid encompasses its core rational; this entails taking into consideration the person, such as the user(s) of the IS application, and the recipient of the use of that information (for Seedhouse 'the clinician' and 'the patient') and their informational needs and wants. Seedhouse sees this as the layer of 'practicality'.

Seedhouse recommends that the Ethical Grid is deployed like any other tool designed to do a job; such as "to make ethical reasoning explicit" (Seedhouse 1998). Also, that it is useful if this is done working in groups or teams. Note that Seedhouse has also integrated the Ethical Grid into a Value Based Decision-Making model (VDM) (Seedhouse 2005) and created a software based tool to support this, called VIDe (www.vide.co.nz). Within this "the system does not tell you which values are

best or right or true or objective", rather it "exposes all value-judgements…for scrutiny by all who are making them and have an interest in them" (Seedhouse 2005, p101).

The Ethical Grid will be similarly deployed either with respect to the diagnosing real world situation in Cycles 1 & 2 of SISTeM and/or the intended & actual humanchine agency issuing from the debates engendered through the methodology. It will then be used in ethically underpinning the subsequent informated socio-technical agency implementing informated humanchine solution in Cycle 3 of SISTeM when deployed (Brooks et al. 2008).

THE SOFT INFORMATION SYSTEMS AND TECHNOLOGIES METHODOLOGY (SISTEM): AN OVERVIEW

SISTeM is a 2nd generation Soft Systems Methodology (SSM), an offspring of Checkland's original SSM (Checkland 1981; Checkland 1990; Checkland et al. 1997). It was devised to gain leverage from Checkland' approach to facilitating stake holders in both their delineating and addressing issues within a situation that they have, themselves, deemed problematic. SISTeM, unlike its progenitor, has three cycles rather than one; Figure 2 illustrates the nature of these cycles. Considering each in turn:

SISTeM Cycle 1 Arriving at an Initial Ethical Decision in Principle

The intended output of this cycle, drawing on Checkland's original SSM (Checkland 1981; Checkland 1990; Checkland et al. 1997) an initial decision 'in principle of intent' as to what the informated solution that is to be aimed for. This is 'what', at a high level, will be aimed for. This is achieved by engaging stakeholders, and in particular the problem owner(s) in compiling, through their experience of the real world problem situation a 'rich picture'. This is compiled out of their own and other's experiences of the prevailing situation that for them presents difficulties and requires some means of addressing it. Any solution which entails taking cognizance of a number of interacting factors: tasks that need dealing with, what are possible interventions that might address them, the prevailing market and social situation, in particular power and political agendas held by a wide audience of stakeholders. Current (information) technologies & systems and any relating concerns will be brought to the fore. Also, using Seedhouse's 'Ethical Grid' (Seedhouse 1998), prevailing ethical issues that need to be, if not dealt with then certainly accommodated, within the finally delivered solutions are brought to the fore and analyzed. All of which will be compiled into a 'rich picture' of the situation at hand. The real and potential resources, of all forms, available to both support the problem solving process and the final chosen solution will be delineated. A rich picture, consisting of these and any other salient issues is compiled. Also expressive models of existing problematic business processes may be constructed.

Having gained this overview of the situation and delineated the presenting problems, one or a number of human/machine ethically (Seedhouse 1998) 'relevant systems' (Atkinson 1997) are delineated (see below for examples). Note that these are not systemic representations of the world: as are the expressive models. These are 'relevant to the situation' and the problems in it. Their role is, when compared with the existing situation within the organization or social setting, to formulate an agenda for debate about solutions in principle. Stakeholders use the differences to then engage in that debate with each other as to what ought to be done about the current problems. The result of these argued deliberations is the identification of one, or a number, of putative, in principle ethically informed, socio-technical solutions. It ought to be noticed that as yet no final commitment to implement the solution is made; only a decision in principle. At this point, however, the real wrangling and politics takes place and decisions as to what 'will' be realized in the real world commences as the stakeholders enter Cycle 2.

SISTeM Cycle 2: From Ethically Informed Decisions in Principle to Decisions on Practice

This Cycle 2 is directed at achieving a final decision by stakeholders about budgeted, systemically desirable, culturally feasible, resource and design skills allocated decision as to what will be the delivered informated socio-technical solution on the ground, to be used in practice in the organization. The first stage in doing this is: to appreciate what was the initial decision in principal and its ramifications; what power, individual or coalition is backing it, and what potential resources are available to bring the delineated human/machine activity system to fruition in the real world. The ramifications of any failure to achieve an effective realization of the structurated humanchine activity system will also be considered. Of particular importance is the influence of corporate or organizational political agendas and how they are to be either dealt with, or conversely, used to gain leverage towards achieving a successful realization of the chosen informated socio-technical solution. At the beginning of Cycle 2 the rich picture and previous debates about the achievement of the initially delineated solution(s), in particular the issues of power, is reappraised and upgraded in the light of what has come out of Cycle 1 and any change occurring in the prevailing organizational circumstances. The ethical arguments deployed for and against the initially proposed socio-technical solution needs, also, to be taken into account and revisited. Who would be responsible, the 'Change Agents', the team who would be realizing the proposed informated socio-technical solution are appointed. If

formalized, this could be carried out by a project manager and team, along with project management tools and techniques found with in many information systems implementation or as here, their realization.

Having gained a detailed appreciation, through Cycle 2, of the context within which the decision and scoping of the final informated socio-technical solution were made, an upgrade of the existing or even a new solution arising from the actual decision on the '…to be realized informated socio-technical solution…' will be made. Embedded in this envisioned solution will be the ethical basis on which it stands. Again, this agency will have been informed by reference to Seedhouse's ethical grid. The change agents tasked with bringing into being this delineated 'informated ethical socio-technical solution' will also be identified. The ethical grid is also brought into play here to inform the decision making and resulting delineation of the actual informated socio-technical solution to be implemented in the real world. Socio-technical representational tools will again be deployed to achieve this. These include informated business processes designs. The stakeholders, alongside socio-technical professionals, will join together to arrive, through processes of debate and decision making, at a design of what the informated socio-technical solution that will be implemented and subsequently enacted in the organizational or social setting. The ethically, culturally and systemically informed decision in practice acts as a point of departure from which the actual socio-technical solution will be implemented, or rather, realized through the enactment of the stages of Cycle 3 of the SISTeM approach.

Cycle 3 Realizing the Agreed Solution

Cycle 3 focuses on taking both of the 'decisions of principle', in Cycle 1, and 'decisions on practice' in Cycle 2 and bringing them to fruition. This is achieved by, firstly gaining an ethically informed commitment to support with time and resources the implementation of the socio-technical ethically based decisions as to what a solution to the prevailing socio-technical problem(s) ought to be. The change processes entailed in the solutions implementation will also be delineated. Engaging, the stakeholders in a final ethically informed debate as to 'how' the envisaged solution will come into being is the underlying reason for the need for this cycle. Again Seedhouse's Ethical Grid is deployed to facilitate the informated socio-technical solution issuing from the deployment of the SISTeM approach. Such ethically informed agency entails the people who would act to bring about, ethically, the delineated and agreed upon problem, working alongside those who with information systems technologies and software applications become the solution to the problem originally delineated in Cycle 1 and further refined through Cycle 2.

Building Ethicality into the Results of Deploying the SISTeM methodology

The ethics associated with clinical practice is a very import facet of health, and clinical ethics committees are an established component in the delivery of care and research into it. (http://www.ethics-network.org.uk). As a result of a project directed toward scoping the electronic patient record (EPR) system for the UK National Health Service (NHS), specific tools and techniques of the SISTeM methodology were deployed (Atkinson 1989). One study that formed part of this exercise was to define, using the methodology, how a particular functionality of the EPR would facilitate operational resource allocation. A particular example of this can be seen in the description of a module within the record system that would facilitate the allocation of patients to radiotherapy machines and radiology staff for both diagnostic and treatment purposes. SISTeM, modeling was used to specify the function of the radiotherapy application. Figure 3 provides an overview design of the resource allocation application that was designed. A more detailed design of the application using traditional Data Flow Diagram (DFD) techniques can be found in Appendix I.

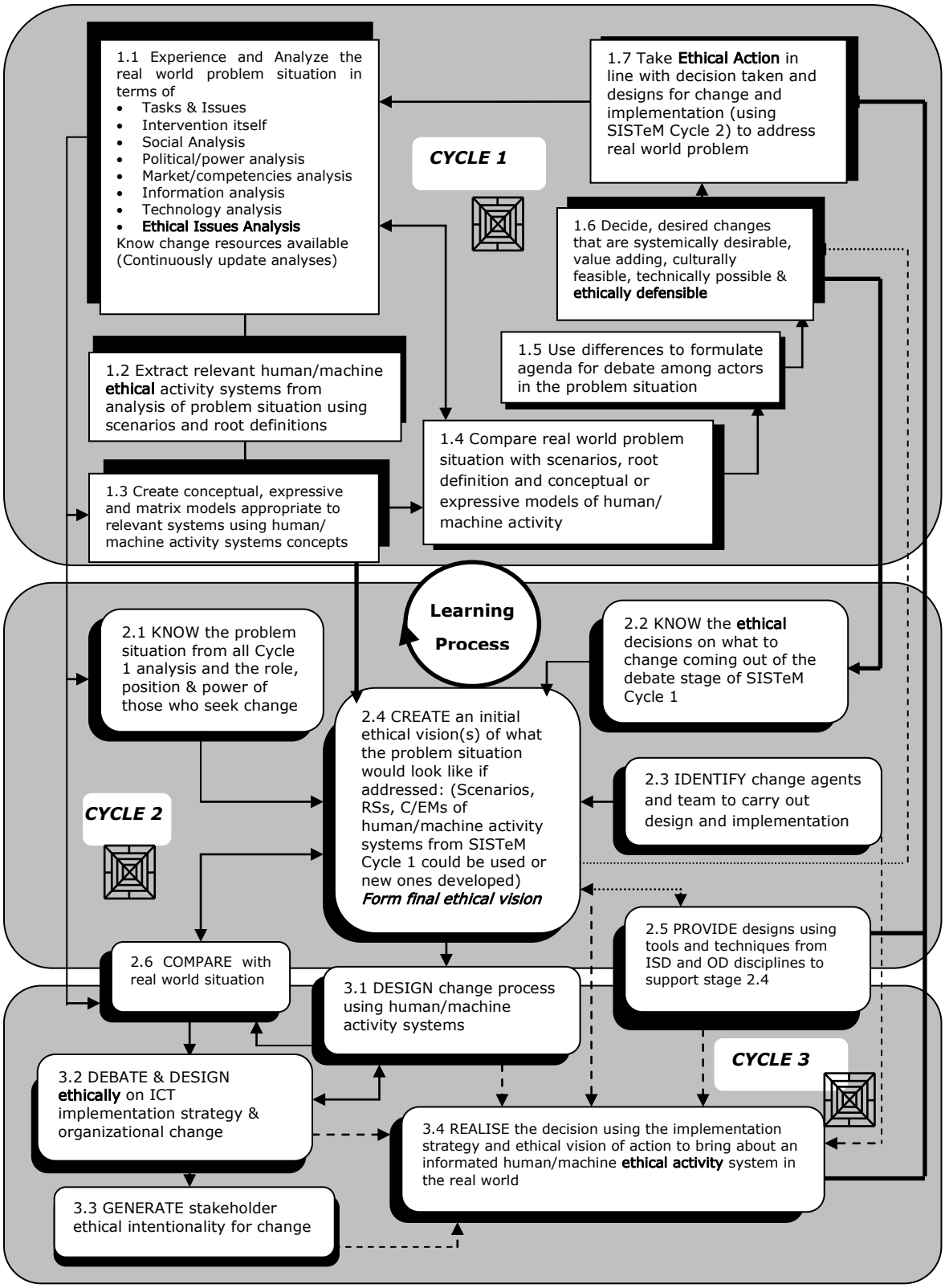

Figure. 2 The Ethicalised Soft Information Systems & Technologies Methodology (SISTeM)

Root Definition of the Radiotherapy allocation

- A Radiotherapy Patient Treatment Slot Allocation Information System, operated by the slot allocation manager and owned by the Director of Information that enables the patient to be allocated to slot in the radiotherapy machines by:
    - Providing information about the patient
    - Receiving notification of a referral
    - Presenting information about the test and investigations
    - Present details of diagnosis, site, fractions required, stage, urgency
    - Provide accrual of referrals on a daily weekly basis
    - Create overview of machine slots over next year, and their allocated status
    - Capture degree of urgency and details of treatment pattern and type of machine suitable
    - Schedule of machine availability - slots open/closed
    - Capture allocation of machine slots for the fractions required
    - Notify patient, GP (or other referee) of times and treatment and capture confirmation of intention to attend
    - Download slot allocations into radiotherapy machine, planner, simulator treatment
    - Accrue slots allocated on the matrix for the numbers of fractions prescribed along with patient details and when these have been undertaken

These activities were then compiled into a model against which specific ethical components from the Ethical Grid (Seedhouse 1991; Seedhouse 1998) were attributed to each of these activities.

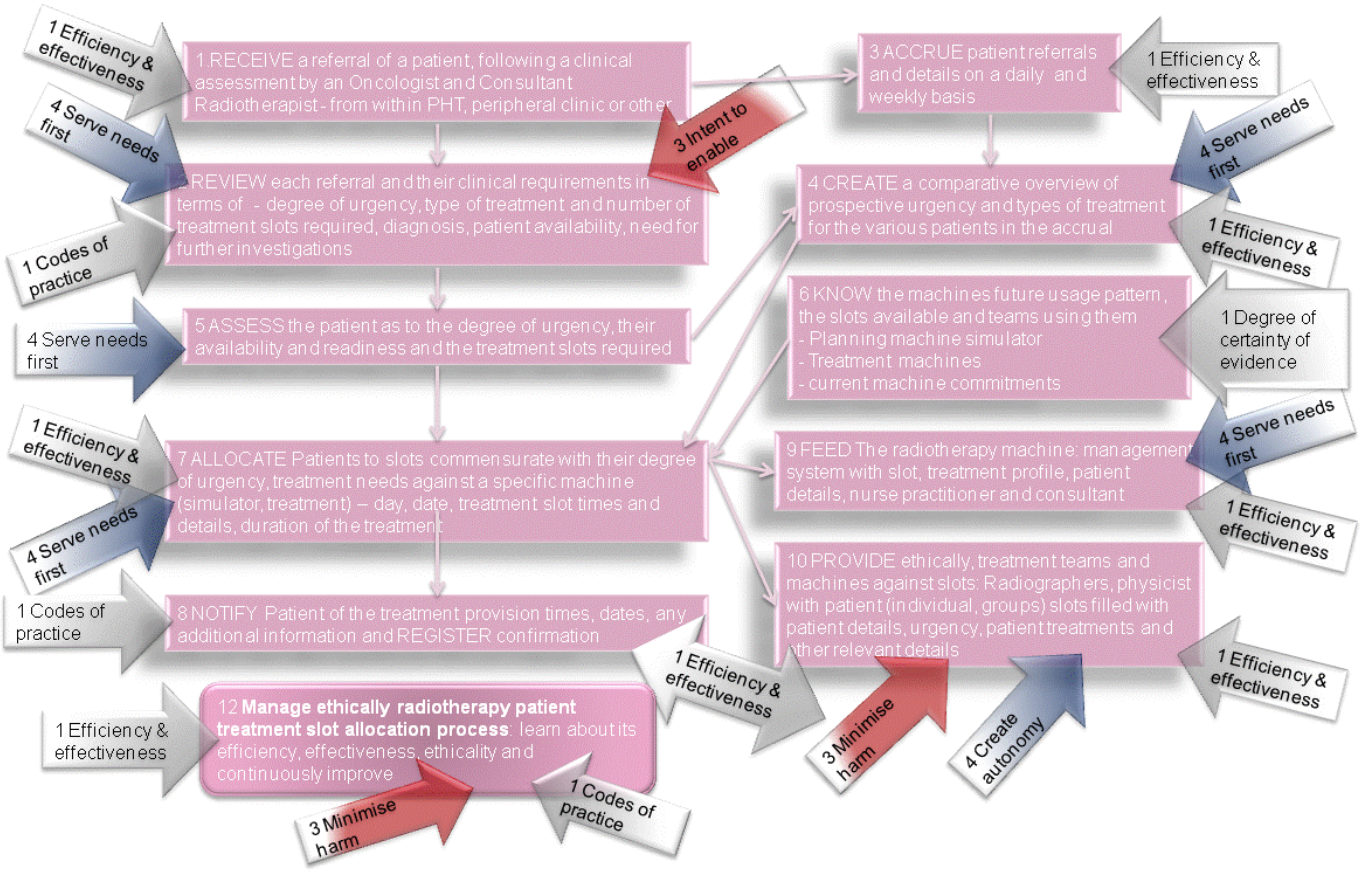

Figure 3. The Ethicalised Radiotherapy System Activities Humanchine Slot Allocation Process

For example, in Activity 1, the elements from the Ethical Grid that might be seen as key for drawing out the ethical considerations are the concepts around effectiveness and efficiency of action. In this case, ensuring that the information received is as accurate and relevant as possible. This leads into Activity 2, the review of the referral and clinical requirements. In addition to the technical requirements, the ethical considerations are a focus on the needs of the user(s) of the IS application and the recipient of the use of that information, trying to do the most positive good (beneficence) and finally taking into consideration codes of practice (e.g. from the British Computer Society/ACM).

CONCLUSION

Moor noted, two decades ago, with respect to computing, and is equally relevant to its progeny, information systems: 'We are open to invisible abuse or invisible programming of inappropriate values or invisible miscalculation. The challenge for computer ethics is to formulate policies which will help us deal with this dilemma. We must decide when to trust computers and when not to trust them. This is another reason why computer ethics is so important' (Moor 1985).

SISTeM, as explored above, aims to support its users to arrive at informated human/machine solutions to real world problems. It is not a purely instrumental approach as it engages peoples, along with their existing and prospective computerized information systems, in a process of debate as to what ought to be decided upon with respect to socio-technical solutions to address a problem situation. Such a debate cannot be solely about the efficiency and effectiveness of the prospective informated socio-technical systems to be developed and implemented; although these are necessary conditions for any solution. Rather they have, it is argued here, to be ethically defensible in the wider constituency to those who will employ them and whose effects they will be subject to. To that end it argued here that a SISTeM methodology, incorporating the Ethical Grid, giving rise to informated socio-technical solutions may meet not only its internal criteria that they are systemically desirable, value adding, culturally feasible, technically possible but they are also ethically defensible to its constituents and those who are subject to its socio-technical interventions in the real world.

REFERENCES

1. Adam, A. (2001) Computer ethics in a different voice, *Information and Organization*, 11, 235-261.
2. Albrechtslund, A. (2007) Ethics and technology design, *Ethics and Information Technology*, 9, 1, 63-72.
3. Atkinson, C. J. (1989) Ethics: a Lost Dimension in Soft Systems Methodology, *Journal of Applied Systems Analysis*, 16, pp 43-53.
4. Atkinson, C. J. (1997) Soft Information Systems and Technologies Methodology (SISTeM): A Case Study on Developing the Electronic Patient Record, *Requirements Engineering*, 2, 1, 1-22.
5. Atkinson, C. J. (2000) The 'Soft Information Systems And Technologies Methodology' (SISTeM): An Actor Network Contingency Approach To Integrated Development, *European Journal of Information Systems*, 9, 2, 104-123.
6. Atkinson, C. J. (2002) The Multidimensional Systemic Representation of Actor Networks: Modelling Breast Cancer Treatment Decision-Making, *Proceedings of the 35th Hawaii International Conference on System Sciences (HICSS)*, Big Island Hawaii, 1122-1131.
7. Avison, D. E., and Fitzgerald, G. (2006) Information systems development: methodologies, techniques & tools, (4th ed.), McGraw-Hill Education, London, xxi, 645 p.
8. Baase, S. (2008) A Gift of Fire: Social, Legal and Ethical Issues for Computers and the Internet, (3rd ed.), Prentice-Hall, New Jersey.
9. Banerjee, D., Cronan, T. P., and Jones, T. W. (1998) Modeling IT Ethics: A Study of Situational Ethics, *MIS Quarterly*, 22, 1, 31-60.
10. Bell, F., and Adam, A. (2004) Whatever Happened to Information Systems Ethics? Caught between the Devil and the Deep Blue Sea, in B. Kaplan, D. Truex III, D. Wastell, T. Wood-Harper and J. I. DeGross (Eds.), *Information Systems Research: Relevant Theory and Informed Practice, IFIP 8.2 Conference*, Springer, Boston, 159-174.
11. Brey, P. (2000) Disclosive Computer Ethics, *Computers and Society*, 30, 4, 10-16.
12. Brigham, M., and Introna, L. (2007) Invoking politics and ethics in the design of information technology: undesigning the design, *Ethics and Information Technology*, 9, 1, 1-10.
13. Brooks, L., and Atkinson, C. J. (2008) Exploring The Potential Of The Ethical Grid For Informing Decision-Taking Practices In The Soft Information Systems & Technologies, Methodology (SISTeM), *Proceedings of International Conference on Information Systems (ICIS)*, AIS, Paris, France.

14. Checkland, P. (1981) Systems Thinking, Systems Practice, Wiley, Chichester.
15. Checkland, P., and J Scholes (1990) Soft Systems Methodology in Action, Wiley, Chichester.
16. Checkland, P., and Holwell, S. (1997) Information, Systems and Information Systems: making sense of the field, Wiley, Chichester.
17. Checkland, P., and Poulter, J. (2006) Learning for action: a short definitive account of soft systems methodology and its use for practitioners, teachers and students, John Wiley, Chichester.
18. Couger, J. D. (1989) Preparing IS Students to Deal With Ethical Issues, *MIS Quarterly*, 13, 2, 211-218.
19. Fischer, J. M., Kane, R., Pereboom, D., and Vargas, M. (2007) Four Views on Free Will, Blackwell Publishing.
20. Flanagan, M., Howe, D., and Nissenbaum, H. (2008) Embodying Values in Technology: Theory and Practice, in J. van den Hoven and J. Weckert (Eds.), *Information Technology and Moral Philosophy*, Cambridge University Press, Cambridge.
21. Harris, I., Jennings, R., Pullinger, D., Rogerson, S., and Duquenoy, P. (2008) Helping ICT professionals to assess ethical issues in new and emerging technologies, *British Computer Society*, 1-3.
22. Hirschheim, R., and Klein, H. (1989) Four paradigms of information systems development, *Communications of the ACM*, 32, 10, 1199-1216.
23. L'Etang, J. (1992) A Kantian approach to codes of ethics, *Journal of Business Ethics*, 11, 10, 737-744.
24. Moor, J. H. (1985) What is Computer Ethics? *Metaphilosophy*, 16, 4, 266-275.
25. Mumford, E. (1981) Values, Technology and Work, Kluwer, Dordrecht.
26. Nathan, L. P., Friedman, B., Klasjna, P. V., Kane, S. K., and Miller, J. K. (2008) Envisioning systemic effects on Persons and Society Throughout Interactive System Design, *Proceedings of ACM Conference on Designing Interactive Systems (DIS'08)*, ACM, Cape Town, South Africa.
27. Quinn, M. J. (2006) Ethics for the Information Age, (2nd ed.), Pearson International Edition.
28. Reynolds, G. W. (2007) Ethics in information technology, (2nd ed.), Thomson Course Technology.
29. Seedhouse, D. (1991) Liberating medicine, Wiley, Chichester, xxi, 175 p.
30. Seedhouse, D. (1998) Ethics: the heart of health care, (2nd ed.), Wiley, Chichester, xiv, 232 p.
31. Seedhouse, D. (2002) Total health promotion: mental health, rational fields, and the quest for autonomy, J. Wiley, Chichester, xiv, 155 p.
32. Seedhouse, D. (2005) Values-Based Decision-Making for the Caring Professions, John Wiley & Sons, Ltd, Chichester.
33. Smith, H. J. (2002) Ethics and information systems: Resolving the quandaries, *SIGMIS Database*, 33, 3, 8-22.
34. Smith, H. J., and Hasnas, J. (1999) Ethics and Information Systems: The Corporate Domain, *MIS Quarterly*, 23, 1, 109-127.
35. Stahl, B. C. (2005) A critical view of the ethical nature of interpretive research: Paul Ricoeur and the other, *Proceedings of 13th European Conference on Information Systems (ECIS)*, AIS, Regensburg, Germany.
36. Stahl, B. C. (2008) Ethical Issues of Information and Business: A Critical Perspective, in K. E. Himma and H. T. Tavani (Eds.), *The Handbook of Information and Computer Ethics*, John Wiley & Sons, Inc., Hoboken, New Jersey, 311-335.
37. Stahl, B. C., and Brooke, C. (2008) Acting Like a True Professional: The Contribution of Critical Research in Information Systems, *Communications of the ACM*, 51, 3, 51-55.
38. Tavani, H. (2008) ICT ethics bibliography 2006-2008: A select list of recent books, *Ethics and Information Technology*, 10, 1, 85-88.
39. Tavani, H. T. (2004) Ethics and technology : ethical issues in an age of information and communication technology, (International ed. ed.), Wiley, Hoboken, N.J. ; [Great Britain], xxiv, 344 p.
40. Taylor, M. J., and Moynihan, E. (2002) Analysing IT ethics, *Systems Research and Behavioral Science*, 19, 1, 49-60.
41. Wood-Harper, A. T., Corder, S., Wood, J. R. G., and Watson, H. (1996) How We Profess: The Ethical Systems Analyst, *Communications of the ACM*, 39, 3, 69-77.

APPENDIX I

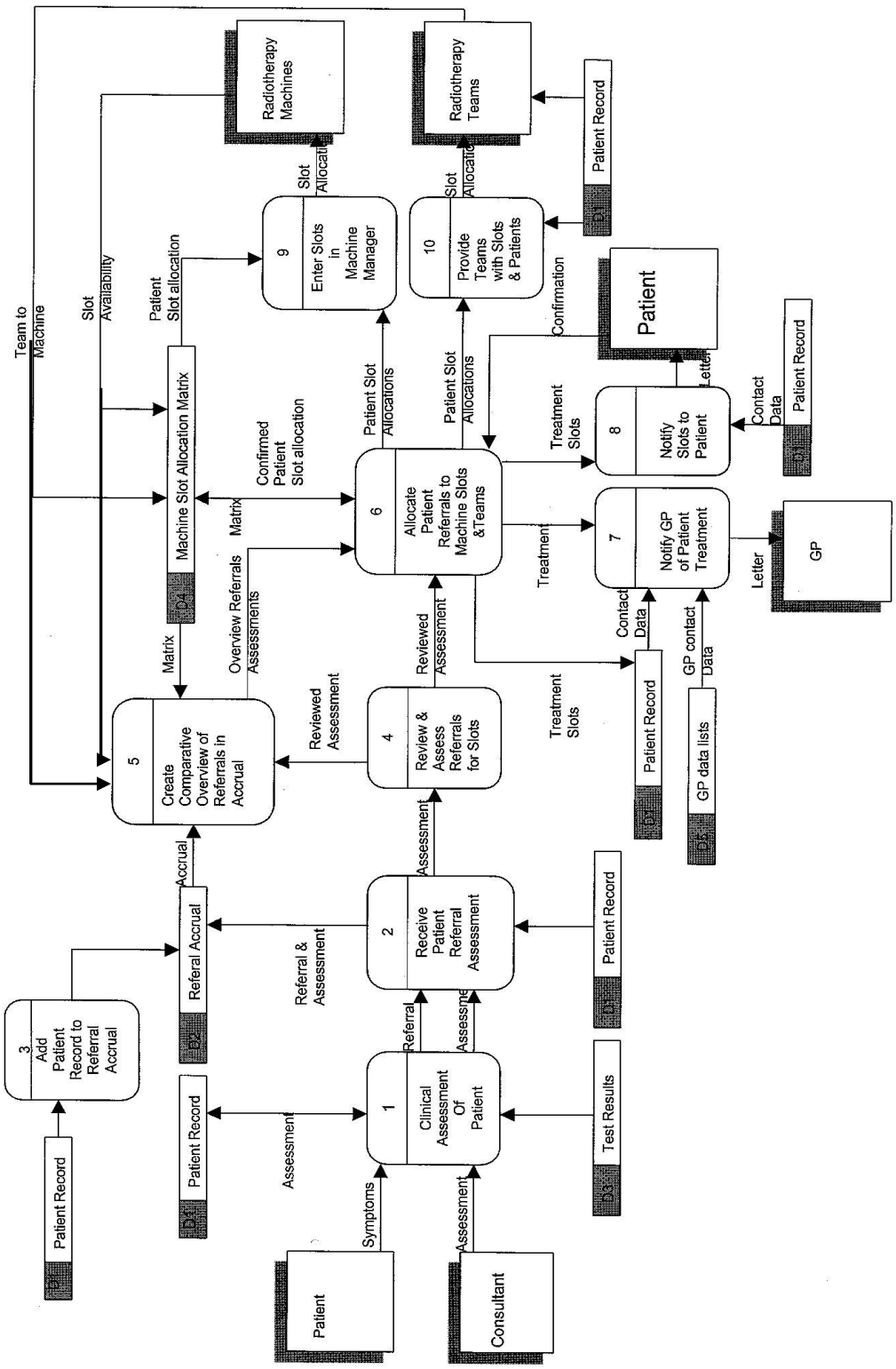

Figure 4. DFD showing detailing the design of the patient radiotherapy machine slow allocation