A SYSTEMS APPROACH TO BUSINESS PROCESS EVOLUTION

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ABSTRACT

The “First World” has become an information society, increasing the complexity of management in a business environment which is characterised by complexity, simultaneity, asynchronicity and de-centralisation. In this world, information systems are no longer simply an adjunct to business, but are at its heart; automating, informating, virtualizing and transforming organisations and work, social groups and human interaction. In this environment one might expect that business managers would readily see the value of, and hence adopt, the use of systems methods. However, managers have largely ignored the systems sciences, preferring instead to adopt a series of seemingly endless management "fads," including Business Process Re-engineering (BPR) and Total Quality Management (TQM). These "fads" are more attractive to practising managers than systems methodologies because they are more easily "sold" as supportive of the pragmatic mind-set. Management take-up of "fads" stems largely from the fact that; *"What men really want is not knowledge but certainty"*.

However, human activity systems are complex, self-regulating and adaptive, and so too must be the systems by which change is planned and managed. Self-generated and self-organised evolutionary change processes can enable systems to adapt, evolve and improve as circumstances, perceptions and requirements change. For successful business process evolution (BPE), the consideration of change and its effects must frequently be analysed and interpreted at more than a single level and in more than a single dimension, often in many (interleaved) cycles of exploration, understanding and change.

Developing a shared appreciation among a coalition of organisational stakeholders of "the best way forward" generally fosters and enables improvement in complex organisational systems. Such a shared appreciation can benefit from a framework that promotes and supports teamwork, synergy, mutual understanding and conflict resolution, in order to support a fusion of horizons.

Organisational effectiveness is difficult to define, often unknown and generally a moving target. BPE, therefore, must be underpinned by the recognition that there may be many different, and equally valid, views of what might constitute “organisational improvement” and how such “improvement” might be sought. In order to achieve an agreement over desirable, feasible and beneficial change, BPE

must somehow address this complex set of pluralist positions. It must also seek incremental improvement through learning, negotiation and compromise while recognising the importance of IT, IS and IM as integral parts of the broader business system. In the Information Economy, BPE must also support a variety of technologies, tools, techniques and approaches from the domains of Business Analysis and Information Systems, to support exploration, understanding and change, using principles of method from both the hard and the soft paradigms.

This paper sets out an evolutionary approach to organisational change; especially change involving information systems.

The approach described is founded upon the collaboration of people involved in the area of concern; a process of critical enquiry; a focus on social practice; and a deliberate process of reflective learning. The approach is systemic in nature, systematic in its coverage and pragmatic in its application, allowing a balance to be struck between creativity and control. Focusing on enabling systems, rather than on methodical phases, it views organisational change as systems based, rather than project based and recognises that change must necessarily be planned for and managed, but should be systemic rather than formulaic.

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We shall not cease from exploration
And the end of all our exploring
Will be to arrive where we started
And know the place for the first time.

(from *Four Quartets* by T.S. Eliot)

In a paper by Professor Wildon Carr given on November 7th, 1924 at the Lyceum Club, Bergson's theory of knowledge and Einstein's theory of relativity are used to illustrate a 20th century revolution in philosophy and science regarding two key factors in knowledge. These two factors are given as, first the activity of the mind in knowing, and second, the activity of the world in revealing itself.

Carr explains that for Bergson, intellect is not designed for speculation but for action, and for speculation only in so far as it serves action. The intellect is thus *"the form of mentality that serves us in our life activity"*. It does not *"reveal things as they are"*, but *it "frames the actions that serve us in our life activity"*. Einstein's principle of relativity tells us that we are observers of nature, but the nature we observe consists of phenomena and systems moving relatively to one another. Thus, for example, there is no system or place in a system which is absolute, so that by reference to it we may determine absolutely the velocity of a movement. So to measure the movement of any system we must adopt a standpoint. For Carr the most revolutionary discovery of modern science concerns the principle of discovery itself, and the frame of reference that every observer of nature must select when we have nothing absolute to refer to.

"On each side, mind and nature, the idea of the absolute - absolute knowledge of absolute reality - has given place to the principle of relativity."

(Carr, 1924)

In matters of human activity, means and ends, causes and effects, observations and interpretations, successes and failures, facts and rules are all relative to the frame of reference of the observer. Theories and models that seek to predict actions and outcomes, are of limited value in relation to Human Activity Systems, which by definition contain several, possibly conflicting, goal seeking or relationship maintaining, subsystems, and are therefore (at their most straightforward) probabilistic rather than deterministic. In attempting to understand human values, motivations and actions in social and organisational contexts, the search for universal, testable and refutable theories has yielded almost nothing. That does not mean, however, that theory has no place in relation to Human Activity Systems, and it certainly does not mean that we should not attempt to develop ideas, general concepts and principles of method in relation to them. What it does mean is that, knowing about, understanding and modelling human activity are interpretive and subjective activities. Because of this a clear separation between theory and practice is not possible.

The link between theory and practice is frequently manifest in the form of a method or approach in which a general framework of ideas is embodied in a way of interfacing with the world of practice. Thus, method (or principles of method) has an important part to play in both the development of theory and the improvement of practice.

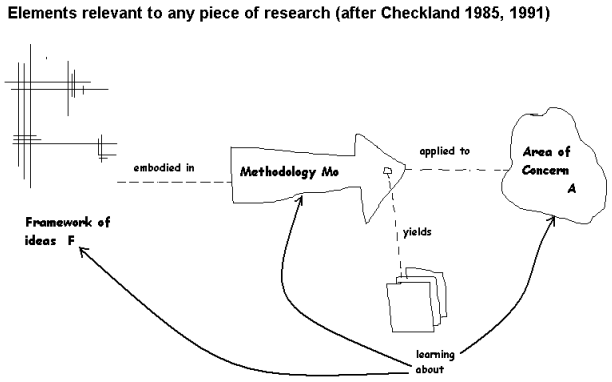

Figure 1: Checkland's Model of the elements relevant to research

The contribution made by this research is set out here as it relates to method, theory and practice, relative to the part that they have played in the interpretive field studies undertaken. Thus, in Checkland's terms, the contribution made can be defined as learning about the framework of ideas that relates to human activity and information systems, methods of intervention, and practice as it relates to human activity systems and their evolutionary development. (Checkland, 1985)

Contribution to Method

"There is no special method that guarantees success or makes it probable. Scientists do not solve problems because they possess a magic wand - methodology, or a theory of rationality - but because they have studied a problem for a long time, because they know the situation fairly well, because they are not too dumb (though that is rather doubtful nowadays when almost anyone can become a scientist), and because the excesses of one scientific school are almost always balanced by the excesses of some other school. (Besides, scientists only rarely solve their problems, they make lots of mistakes, and many of their solutions are quite useless."

(Feyerabend, 1975)

In conventional Information Systems Engineering, the Concept Stage begins with the initial recognition of a need, or a concept for a new system, or for the modification of an existing system. The purpose of this stage is given in technical standard WG 7 N0422 (ISO/IEC, 2001) as: *"to assess new business opportunities and to develop preliminary systems requirements and a feasible design solution,"* .. leading to the point at which .. *"decisions are made whether to continue with the implementation of the solution in the development stage or to cancel further work."*

The same standard defines the Development Stage as beginning with a detailed specification of business and systems requirements and the selected design solution in order to transform these into one or more viable *"products,"* which meet *"the aquirer's"* requirements and can be produced as a *"systems architecture comprised of subsystems, hardware elements, software elements and humans and their interfaces (internal and external)."* Production is defined as assembly, integration and testing, leading to installation, transition and use.

A variety of systems based intervention methodologies have been developed over the last forty years or so, which claim to provide a means of finding solutions for complex problems. These methodologies have predominantly been developed within the academic community, and offered to practising managers as effective tools to cope with the complexities associated with sustainable change in their organisations. In the main, these systems based intervention methodologies have failed to gain general acceptance among practising managers, who tend to view them as too theoretical, too time consuming, too esoteric and not sufficiently concerned with the "real-world".

The "First World" has become an information society, increasing the complexity of management in a business environment which is characterised by complexity, simultaneity, asynchronicity and de-centralisation. (Davis & Davidson, 1991) Information systems are no longer simply an adjunct to business, but are at its heart; automating, informating, virtualizing and transforming organisations and work, social groups and human interaction. In this environment one might expect that business managers would readily adopt the use of systemic methods. However, managers have largely ignored them, preferring instead to adopt a series of seemingly endless management "fads," including Business Process Re-engineering (BPR) and Total Quality Management (TQM). Ellis argues that these "fads" are more attractive to practising managers than systemic methodologies, because they are more easily "sold" as supportive of the pragmatic mindset. (Ellis, 1995) Francois supports this view and

calls for problem solvers to be "*practical in systems terms"* in attempting to solve global problems. (Francois, 1998). Management take-up of "fads" stems largely from the fact that; *"What men really want is not knowledge but certainty."* (Russell, 1981)

Popper wrote of myths, ideas and theories, about the world we live in, as a type of product or artefact. For Popper they represented some of the most characteristic products of human activity, *"exosomatic artefacts"* or *"organs evolving outside our skins"*. The growth of knowledge (used by Popper in an objective and impersonal sense) was for him, enabled by the "production" and "consumption" of theories, whereby theories are criticised, changed and even demolished in order to replace them by better ones. The decisive point for theory in his view was first, how well it solves its problems and second, how progressive it is in allowing critical discussion to show that it has made a difference to the problems its developers were seeking to solve. A theory is taken to be progressive if in using it, newly generated problems are different from the old ones. (Popper, 1972) Scientific knowledge in Popper's terms is founded in a realist tradition which distinguishes between the world of theories and the world of facts to which those theories belong, and is characterised by genuine growth. These two worlds are a world of *thought-process* and a world of the *products of thought processes.* (Popper. 1966) Popper argues that logic is the *organon of criticisms* (rather than of proof) in the search for new theories that contain more information and correspond better to the truth than older theories. Criticism in turn is seen as the main instrument in promoting the growth of objective knowledge about the world of facts. Even the best theories are in Popper's view strictly speaking, false; as they simplify or idealise *the facts*. This leads to the idea of *"versimilitude,"* or nearness to the truth, which accepts that one theory may correspond better than another to the *facts of the real world.* A scientific theory is different from a mere story, Popper argues, because it is embedded in different critical traditions and judged by entirely different standards.

"One should always keep to assertions, to theories, and the question of their truth. One should never get involved in verbal questions or questions of meaning, and never get interested in words."

(Popper, 1972)

However as Ursula Leguin observes in her novel "The Left hand of Darkness;"

"Truth is a matter of the imagination. The soundest fact may fail or prevail in the style of its telling."

(Leguin, 1991)

Feyerabend sees science as an essentially anarchistic enterprise, in which theoretical anarchism is both more humanitarian and more likely to encourage progress than *law-and-order* alternatives. For Feyerabend the only principle that does not inhibit progress is; *anything goes.* He further suggests that there should be no distinction between the context of discovery and that of justification, or between theoretical and observational terms. Science, Feyerabend argues, is similar to myth, in that both cap common sense with a theoretical superstructure, contain theories of different degrees of abstraction and unite the objects and elements of common sense in different ways.

Both science and myth are protected and their central ideas, beliefs and tenets are protected by an unwillingness to defy the established lines of classification, and by the emergence and adoption of secondary elaborations through which the core may still be seen to hold. For Feyerabend, a science that insists on possessing the only correct method and the only acceptable results is ideology.

"A mature citizen is not a man who has been instructed in a special ideology, ...and who now carries this ideology with him like a mental tumour, a mature citizen is a person who has learned how to make up his mind and who has then decided in favour of what he thinks suits him best. He is a person who has a certain mental toughness (he does not fall for the first ideological street singer he happens to meet) and who is therefore able consciously to choose the business that seems to be most attractive to him rather than being swallowed by it."

(Feyerabend, 1975)

Jackson supports the pragmatic use of systems ideas, while remaining critical of pure pragmatism.

"...Pragmatists, therefore do not worry about 'artificial' theoretical distinctions.

They concentrate on building up a 'tool kit' of techniques that can that can be used as required of the real-world situation. Proven techniques from different strands of management science are employed together in the course of problem solving if the situation warrants it. The choice of techniques and the whole procedure is justified to the extent that it brings results in practice...Systems people should be 'activist' seeking out problems that should be tackled using systems ideas. Available theory should be used pragmatically and eclectically..."

(Jackson, 1991)

If systems based methods tools and techniques are to be useful and used, then they must be flexible and progressive (that is capable of genuine growth and improvement) accessible and explicable. The search for universal truths (e.g. Buchanan, 1997) is a fruitless one except perhaps for those that may relate to the demonstrative or mathematical sciences. In the empirical sciences theories are accepted as "true" or as a close approximation to the truth if they are tested and found to be pragmatically useful, or successful. In matters of human activity, reason is not universal and unreason cannot be excluded.

Models are always reductionist, simplistic and incomplete. Like theories (in Popper's terms) they are an incomplete representation of "the truth" and therefore "false" or at least unable to represent the full and rich variety of the phenomenon they represent. The answer is not to build ever more complex (mega or meta) models but rather to *"model simple and think complicated."* (Pidd, 1996) The requisite variety of a model is an emergent property of the interaction between the model and its human users, and not a property of the model per-se. Use of models and methods within BPE has shown it best to start with small, simple, focused models, and to add complications only as and when they become necessary, an explanation for which follows.

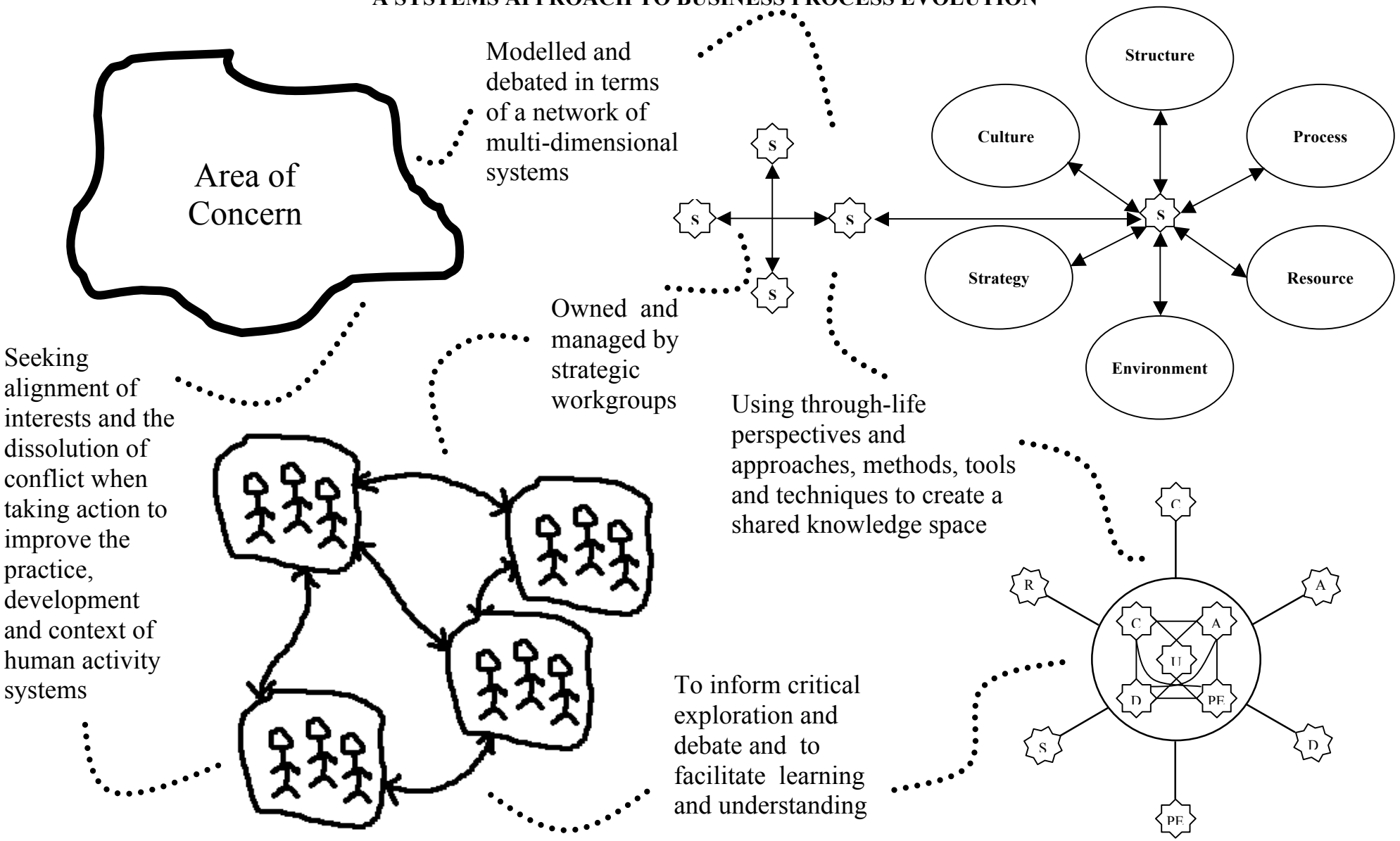

Figure 2: BPE as the application of Methods, Tools and Techniques

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A Human Activity System may be defined in terms of a particular set of linked processes, which consume and produce resources, within an available, important and ever-changing environment, guided, motivated and constrained by an evolving strategy in accordance with a prevailing culture of politics, paradigms, values standards and norms.

Each of these various dimensions may be thought of as they relate to the target system (which may itself consist of a number of subsystems or form part of a super-ordinate system) or modelled in general terms as independent of specific activity systems. The commercial environment, for example, is described in industry and government reports, surveys, trade journal articles, the media and so on. Organisational resources will be modelled as budgets, financial and management accounts, appraisals of investment and risk, staff CV's, technology infrastructures etc. Such descriptions and models may prove to be useful and informative, even instrumental in systems operation and improvement, even where they have been produced with no consideration whatsoever of the systems alongside which they are later considered.

A wide variety of models and methods exist to describe the above dimensions. A small number of commonly cited examples from existing CBIS practice include:

Process:

- Activity Diagrams
- Flowcharts
- Process Maps
- Use Cases
- Control Diagrams
- Value Chains

Resources

- People: organisation charts, skills matrices, capability requirements, personnel records
- Finance: budgets, financial accounts, CBA & investment models, accounting ratios
- Information: object models, ERDs, ELHs, IS maps, database, ERM & library schemas
- Technology: system and network architectures, protocols and standards
- Physical Resources: accommodation, equipment, materials & consumables
- SWOT

Environment

- PESTLE
- Systems Maps
- Competitive Forces Models

Strategy

- Mission Statements
- Aims & Objectives
- CSFs
- Policy Principles
- Doctrines & Codes of Practice/Conduct
- Plans and Key Performance Indicators

Culture

- Rich Pictures
- Problem themes
- Issues and conflicts
- Power structures
- Influence Diagrams
- Cultural Web Analysis of paradigms, beliefs and values

Including **Structure** as a dimension allows for the visualisation of complex interrelationships between dimensions and models, beyond the way in which they appear to relate to a single system or transformation. The structuring of systems models is important for both pragmatic and methodological reasons. Structuring enables models to be constructed as arrangements of quasi-independent parts, in which numerous individually and collectively developed communicating and interoperating Human Activity Systems may be represented.

Complex structures may be formed from systems, or from their component parts, as sequences, hierarchies and networks of activity, or any combination of these basic structural modes. This allows systems and their component parts to be considered collectively, in terms of each or any of the chosen key dimensions, thus allowing for focused debate on issues such as similarity, diversity, co-dependence, responsibility, relevance, quality, availability, priority and so forth.

Research conducted by the Mincau Sodas Open Laboratory (Kulikauskas and Maskeliunas 1999) indicates that sequences, hierarchies, networks and table structures are the natural ways in which people organise formally recorded information. They also demonstrate that it is common to use these structural forms in linked pairs in order to visualise complex phenomena. Their work concerning the visualisation of complex object-oriented designs may be adapted and extended to apply to the consideration of systems.

A Tour is defined as a sequence imposed on a network, such as the attempt to make sense of a complex set of interrelated activities by "walking through it". Structured debate between two or more stakeholders as they follow an object or resource as it passes from activity to activity in a conceptual model, or consider the consequential ripple of implications from system to system, are examples of this class of visualisation.

A Canon is defined as a network imposed on a sequence, representing the multiplicity of associations that may be defined or discovered in relation to a single set of sequential actions or activities. This class of visualisation is important when attempting to determine how multiple systems collaborate in the same chronological sequence of events. Just as a established mathematical proof may play an important part in the solution of many mathematical problems, a sequence of events may have an impact on, or require a contribution from, many different systems.

An Atlas is a hierarchy imposed on a network, allowing (for example) for the separation of "global" and "local" views. Just as a political atlas indicates continents, countries, provinces and districts, a systems atlas allows systems to be classified in terms of one or more hierarchies of types. Typologies include; issue-based and primary-task systems or relate to systems properties such as the nature and purpose of activity, the span of control, the environment of operation, as well as any number of anatomical, political and social considerations.

A Catalogue is a network imposed on a hierarchy, in order to define links between members of the hierarchy or between the members of a number of different hierarchies. Examples of a catalogue in everyday life include a windows shortcut and a thesaurus of words. Systems catalogues may, for example, be used to define networks of influence, the sharing and interchange of resources and commonality or differences of purpose.

An Evolution is a sequence imposed on a hierarchy, in order to identify change over time as sets of an expanding horizon of possibilities. Timelines of activities and the control structures necessary to bound system's behaviour may be used to define the manner in which a sequence of activities affects one or more hierarchies of systems. This form of visualisation is particularly useful when expressing the anticipated effects of change on a network of systems or components.

A Chronicle is a hierarchy imposed on a sequence, allowing a logical sequence of events or activities to be organised and packaged in a variety of ways. This, most basic of system's models, is the form usually employed to represent linked activities, for example in DFD's and systems flowcharts.

While some models appear to provide better direct support for each type of visualisation, systems are generally and readily visualised by individuals (and groups) using models and model structures in combination. Thus important links between different model forms representing the various dimensions of one or more systems may be uncovered and explored through the process of visualisation rather than through a routine methodological transformation, or simply because of the inherent characteristics of models or the forms of expression that they employ.

Models are fragments of description, containing information about some perceived or imaginary state of being. Like any form of information they are most unlikely to meet all the requirements of those who create and use them, even in relation to the basic information qualities of: completeness, conciseness, relevance, accuracy, precision and appropriateness of form.

Models can never be "perfect" because we cannot perceive all that there is to see, or understand all that we perceive. Neither can we fully express the richness and variety of our own perceptions, or share completely the knowledge and experience of others.

Like knowledge and understanding, models are fragmentary, relative and inseparable from ever changing horizons of interpretation. Their use in pairs (or groups) as a means of communicating, exploring and understanding concerns, possibilities, intentions and outcomes through visualisation and debate generates a level of understanding in those involved that could never be captured and reflected explicitly in a new and more complex model set. Thus, in a complex world of open possibilities, many types of model and modes of exploration are useful in understanding situations, aligning interests, dissolving conflict and agreeing upon action. The nature, scope, complexity, precision and accuracy of a model, however, can never be prescribed in advance of the models use. Thus, unless adopting the approach of modelling everything that might prove later to be important, it is best to produce new models, or seek out, explore and extend existing ones, as and when it seems useful to do so in order to increase knowledge and improve understanding.

The BPE method is founded upon the collaboration of people involved in the area of concern; a process of critical enquiry; a focus on social practice and a deliberate process of reflective learning. It is flexible and open rather than anarchistic (defined in the Oxford Encyclopaedic Dictionary, amongst other things as, ungoverned, disordered and confused) but at the same time provides a structure for and guidance over systems phases, features and aspects. It doesn't assume that organisational change can and should be undertaken according to fixed and universal rules. Rather it provides a framework within which the creative talents of participants may be exploited as participants learn more about the circumstances that require their creativity and thus encourages their development. BPE is systemic in nature, systematic in its coverage and pragmatic in its application, allowing a balance to be struck between creativity and control.

BPE focuses on enabling systems, rather than on methodical phases. That is to say the conceptualisation or development of a system is supported by enabling systems rather than dictated by specific methods of conceptualisation and development. These enabling systems are themselves taken to be human activity systems, which can be modelled in precisely the same way as the target systems that they may be used to support. Thus BPE views organisational change as systems based rather than project based. It recognises that change must necessarily be planned for and managed, but is systemic rather than formulaic. Both BPE and formalised project management are interested in the "3 C's" of commitment, communication and co-ordination. (Waters, 1986) However, in BPE primacy is given to communication, through which commitment may be developed and co--ordination achieved. In formalised project management primacy is given to co-ordination, and communication is viewed primarily as an enabling mechanism through which (amongst other things) commitment can be engendered.

BPE provides a framework through which relevant models can be exploited in appropriate ways. Support is given explicitly to Willemain's classification of the primary concerns of "expert modellers" viz;

- Understanding the problem context
- Selecting model categories and gathering the raw materials from which to construct models
- Building models
- Assessing models
- Using the models in order to gain some value

(Willemain, 1995)

Each BPE lifecycle process is linked to the others in a complex web of deliverables, shared resources and understanding. In this model the systems lifecycle is not a linear process of production, but an ongoing set of processes spanning the whole life of the target system. This whole-life perspective includes the production, enhancement, correction, modification, adaptation and improvement of both target and lifecycle systems, which may be usefully considered in terms of and in relation to: Structure, Process, Resource, Environment, Strategy and Culture.

The seven core lifecycle systems are taken as:

- A Concept Formation System
- An Assessment System
- A Development System
- A Production / Enhancement System
- A Utilisation System
- A Support System
- A Retirement System

Each of the core lifecycle systems represents an “enabling system” which may be applied as appropriate at any stage, and level, of one or more target systems. Thus, for example, a Concept Formation System would be used (rather unsurprisingly) to form concepts. Whilst an entirely general application of the framework might involve the generation of concepts as

varied as a shift in cultural values and a new form of data-warehousing search algorithm, for the purposes of this research, and the fieldwork on which it is based, concept formation is centred on conceptual models of human activity systems. The other core lifecycle systems are also focused on human activity systems in an organisational context.

As with SSM, target systems are selected on the grounds that they are in some way relevant to problem solving. This might mean for example that they are, in some manner or measure, desirable and absent, undesirable and present, not understood, or a source of concern or unease. This is very different to the ISO/IEC systems engineering perspective previously outlined.

Each target system may be usefully modelled and considered (through any of the enabling systems) in terms of each of the six key dimensions: structure, process, resource, environment, strategy and culture. The models and methods, which address each of these dimensions, are many and varied, and have been written about extensively, as have the ways and means by which their use may be complementary or interconnected. An account of some of the modelling undertaken for the fieldwork is given in chapter 3, but no attempt is made here to argue the case for one particular type of model above any other.

Models of structure may be logical or physical in orientation, and concerned with the topography and topology of systems components and their arrangements, with examples as varied as a systems network diagram and a job responsibility matrix. Models of process tend to deal with action, collaboration and decision making, as well as the transformation and use of systems resources. The modelling of resources generally requires consideration of the production and consumption of abstract and/or physical resources, as well as abstract, and/or physical, infrastructure requirements, including technology, competency and capability. Environmental models are concerned with influences that emanate from outside the target system. Political, economic, social, technical, legal and ethical (PESTLE) considerations are of importance as is interaction with other systems with which the target system is directly or indirectly linked. Models of strategy include the purposes and plans of (and for) the target system, together with policy principles and ethical considerations. Cultural considerations may include circuits of power and influence, aesthetics, ethics, values, standards and norms.

An Evolutionary Lifecycle for Business Processes

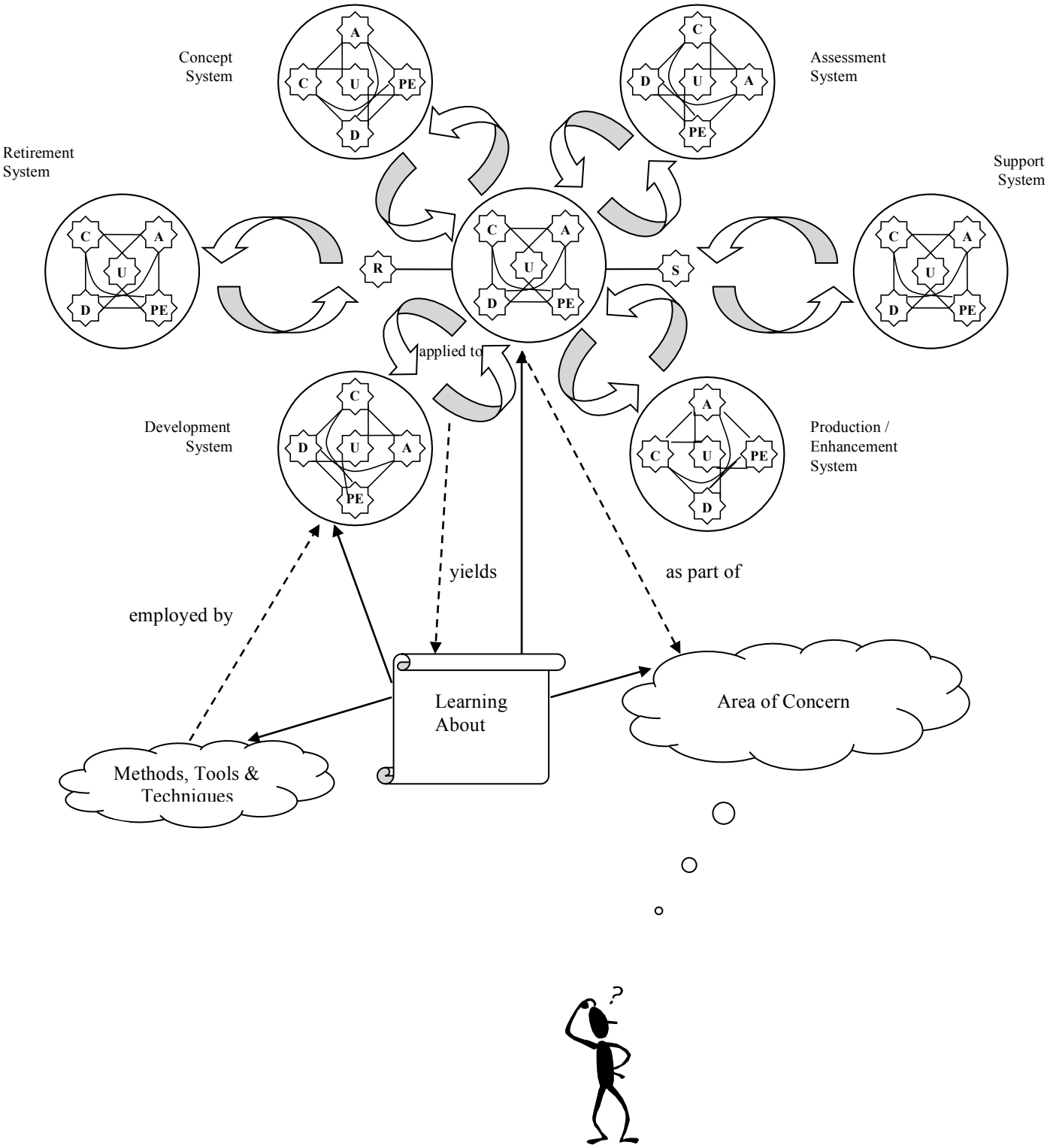

Figure 3: An evolutionary lifecycle for business processes

Figure 1 indicates that the lifecycle of any target system may conceived of as the interaction of systems used to conceive, assess, develop, produce or enhance it and its features, relationships and consequences, and systems to use, support and retire it. The modelling and consideration of each should be undertaken with due regard to the others in order to help to explore and understand requirements, possibilities, intentions and constraints. As enabling systems are used in relation to a target system, learning about the target system, the problem domain, the enabling system and the methods and models employed, makes the improvement of each possible.

Through the use of the Concept System, concepts may be formed and expressed, based on process models of human activity that are informed and/or supplemented by other models as felt useful and appropriate.

The Assessment System enables the consideration, evaluation and comparison of conceptual models and their implications. Models may be compared against existing activities, future plans, other possibilities, resource constraints, policy principles, technical capability, cultural desirability and so on, as deemed appropriate by the systems operators. Consideration of each systems dimension (if only to discount its relevance) provides a focus for the debate over desirable and feasible change. It also promotes learning about the problem situation and the positions of individuals and groups, through the exploration and understanding of component parts and dimensions, and the whole to which they relate.

The Development System takes an outline definition for desirable and feasible change and produces systems designs, production plans, performance and acceptance criteria, implementation and exit plans, and requirements for systems operation and maintenance.

The Production / Enhancement System produces, assembles, integrates and tests technical components and executes plans for reorganisation, training and systems implementation and changeover.

The Use or Utilisation System is concerned with the ongoing operation of the system and with ensuring efficacious, efficient and effective performance together with its availability, integrity, reliability and security.

The support System deals with the provision of technical support, maintenance, logistics, administration and Human Resource Management, so as to enable continued operation and sustainable levels of service.

Systems retirement requires a system to provide for the removal or replacement of the target system and its related operations and support services, Systems may be retired (rather than modified or evolved) as the result of replacement, catastrophic failure, technical obsolescence, changes in organisational requirements etc. Activities will include decommissioning and disposal of equipment, the re-deployment of resources, and, where appropriate the transfer of operations to a replacement system.

The following diagram (Figure 4) illustrates the manner in which the SSM cycle of exploration, understanding and change lies at the heart of BPE. Assessing the implications, feasibility and desirability of conceptual models of notional systems, requires a focus on the resources and key dimensions of both conceptual models and existing organisational practice.

The evolutionary cycle requires the generation of concepts (using a concept generation system) and the use of multi dimensional models, as appropriate, to extend the implications of those concepts into notional systems, considered relevant to problem solving. SSM conceptual models, for example, may be usefully extended to express notional systems not only in terms of process, but in relation to any or all of the other key systems dimensions.

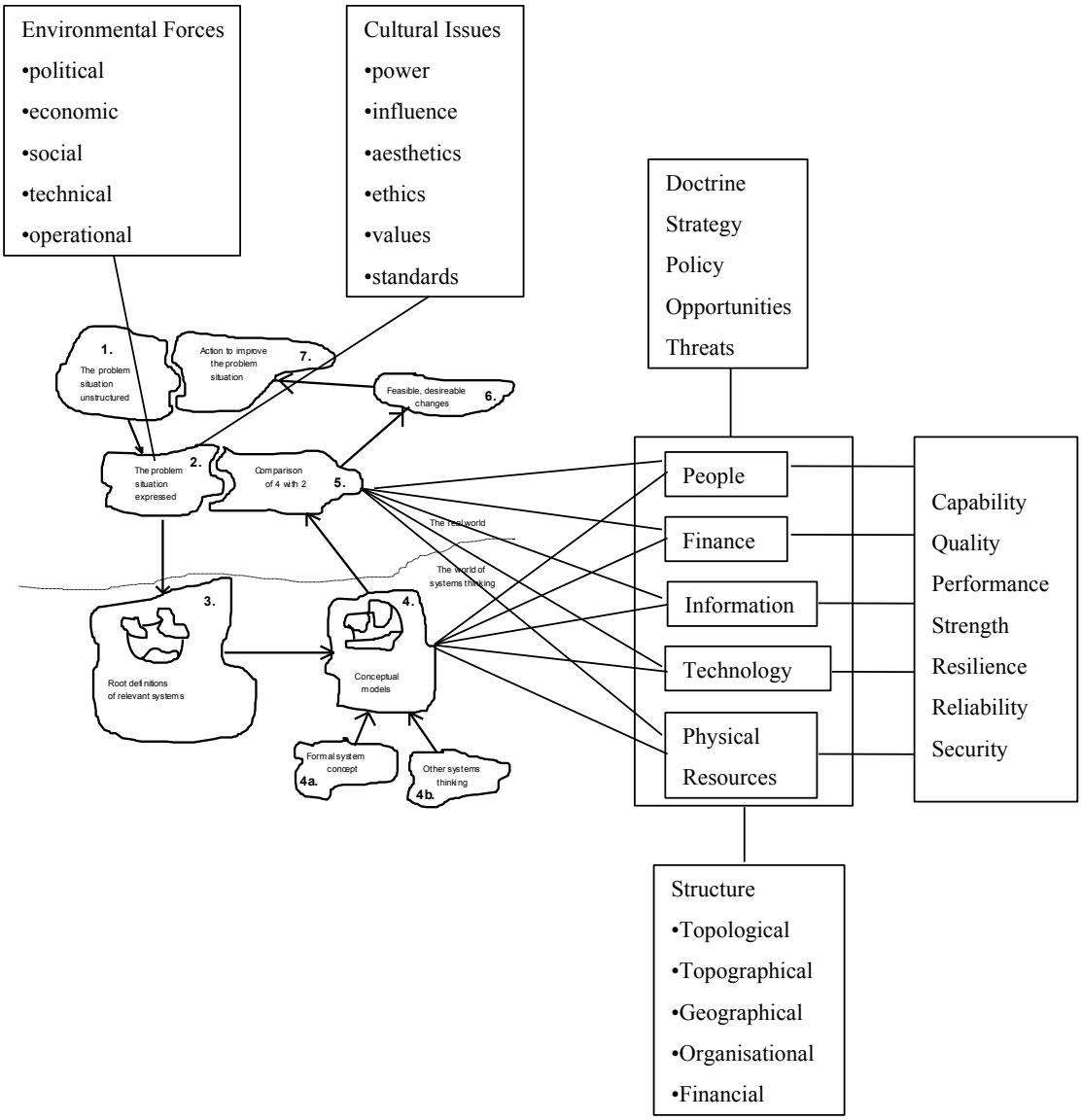

Figure 4: The consideration of notional and apparent system dimensions for concept generation and assessment

Conceptual models focus on activity manifest as ordered sets of verbs. What they do not portray in SSM, and Checkland maintains that it is not intended that they explicitly do so, is the detailed resource requirement for each activity. Stowell argues that conceptual models may be expanded in consultation with the user, "the result of this process is the production of an activity model which attempts to 'solve' the problem, which is at the same time a solution considered feasible by the user" (Stowell, 1985). This approach is clearly attractive, and undoubtedly useful in practice, but it represents activities which are normally taken to occur in SSM in three distinct phases, - conceptual modelling, comparison and change. It also assumes, in similar fashion to Wood-Harper's Multiview, that the transformation of a conceptual model into a systems blueprint is a straightforward matter of *"fleshing out"*.

The fact that conceptual models are not intended to represent an objective empirical reality, but rather a logical description of a particular W for a particular Root Definition, in practice often means that no one conceptual model is implemented as the "new system". Changes are dependent upon negotiation, consensus and compromise over what the system is to be and how its activities should be structured. Even if consensus (by accommodation or otherwise) is possible that is no guarantee that the conceptual model identifying core activities that everyone agrees should be done, will form a blueprint for how it should be done. Historical, political, social, economic and technical issues will inevitably play a part in the determination of desirable and feasible change (Doyle, 1998).

It is at the conceptual modelling phase that the richness of the modelling activity may be enhanced by consideration of systems resource requirements and the structures and strategies that govern them. This enrichening of conceptual models is in line with Checkland's own view that conceptual models should be expanded or enhanced at this stage by other "systems thinking". Whilst the consideration of such matters does not fall into the area of what is normally taken to be systems thinking, there is no compromise of perspective, or mismatch either ontologically, epistemologically or methodologically, from the inclusion of such consideration at this stage. The conceptual modelling phase of SSM is a useful point at which to begin consideration of the resources, which the system therein described, requires. These models, which are complementary to the conceptual models from which they are derived, provide further insight into the notional system described in the relevant root definition, and may be used to broaden and deepen any debate about the models and their implications.

Consideration also, of the structure, processes, resources, strategies, cultures and environment of the "real-world" context, support the assessment of conceptual models, and their implications for organisational change. Ultimately like the conceptual activity models, the models of structure, resource and strategy may be implemented in full, implemented in part, modified, merged or entirely ignored during the definition of desirable and feasible change and subsequent development activity.

Concepts may be assessed through the application of an assessment system (as might be also: the acceptability of development progress, or the value of any one of a number of system's features or implications) using a variety of methods and tools. Structured visualisation, scenario exploration, impact analysis, prototype evaluation, feasibility study and the use of the "Toms Silk Screen" all figured prominently in the field work.

Developing solutions and defining change, and the production and enhancement of new and existing systems, also requires the application of suitable enabling systems. The creation and implementation of a new development system itself requires the application of a (very different) development system, in which the emphasis is on issues such as management structure and accountability, decision making bodies and mechanisms, stakeholder roles and responsibilities, knowledge management and quality assurance.

Thus BPE can be seen as a continuous and cyclical process, addressing the general and the specific, the macro and the micro, small changes and major transformations. The target system(s) may be broad or narrow in scope and be concerned with day to day operations or with organisational change. If target systems are conceptualised in terms of a lifecycle of systems, the processes and methods of intervention become as evolutionary and organic as the systems on which they operate.

Contribution to Theory

One of the primary features of this research was to explore the potential for combining Checkland's Soft Systems Methodology and the more formal methods normally applied to conventional systems engineering activities. SSM and systems engineering methods are not compatible ontologically, epistemologically, methodologically or even in their tools and techniques. When using SSM and Systems Engineering together, at some stage one has to move from exploration and debate to actually doing something tangible. The move from exploration and debate to action in the problem situation constitutes a difficult and important shift, the models of the former being notional subjective accounts relevant to problem solving and those of the latter agreed and verifiable descriptions of an existing or soon-to-be system.

The fieldwork referred to here has found that the notion that one can move from one paradigm to another by "easy stages" is fundamentally flawed. The "paradigm shift" involved in moving from "systems thinking" to "real world engineering" was concluded to be the product of (often intense) intellectual effort, rather than the mechanistic transformation or manipulation of models. It is the move from exploration and debate to action in the problem situation that constitutes the most important shift in the self conscious evolution of human activity systems. The alignment of interests, and the dissolution of conflict, through participative and iterative design and redesign must be informed by the models and methods used, rather than being constrained and driven by them. The models used are far less important than the views that are taken of them and the purposes to which they are put.

The intellect has not evolved for speculation but for action, and for speculation only in so far as it serves action. Models and methods are epistemological devices and guidelines as to how these devices might be usefully deployed. More specifically, models are never a necessary and sufficient representation of reality in their own right. Rather, they are part of a dialog with oneself and/or with others; a text, the exploration of which should increase knowledge and improve understanding, in support of *"the actions that serve us in our life activity"*. (Carr, 1924)

The link between hard and soft methods and models lies not in the mechanistic transformation of one set of models into the other, nor in the grafting or embedding of methods and approaches. It lies in their support of the exploration and understanding of

human activity systems and their interactions, through dialog, critical reflection and self-conscious action.

Knowledge and understanding are fragmentary, relative and inseparable from ever changing horizons of interpretation (Gadamer, 1975 in Cappurro, 2000). These horizons of interpretation may however be, to some extent, shared between groups, communities and cultures and thus knowledge and understanding, to that extent, may indeed be common. A key finding of the research was that this was fundamentally true in relation to the use of method and models. The relationships between models, perspectives and lifecycle stages consisted primarily in the collective understanding of the members of the work group. The links between the methods and models was not given or explicit, but understood. Thus, methods and models, like knowledge and understanding are fragmentary, relative and inseparable from ever changing horizons of interpretation.

Unlike information, knowledge and understanding are, for the most part, difficult or even impossible to "capture" or to "relate" to others. Knowledge is a human capability, residing in people and closely related to their beliefs, commitments and motivations. Like information, knowledge is about context specific meaning. Additionally, knowledge is about action, such that it is always *"knowledge to some end"*. (Nonaka & Takeuchi, 1995)

There is considerable confusion in both managerial and academic circles as to the similarities and differences between knowledge and information. (Marchand, 1998) The emerging discipline of Knowledge Management views the management of knowledge as more important than the management of information, which is in turn more important than the management of data. (Barclay & Murray, 1997).It also recognises that knowledge is as difficult to manage as it is "valuable" as a corporate resource, not least of which because it exists in people as *"part and parcel of human complexity and unpredictability"*. (Davenport & Prusak, 1998)

"We know more than we can tell." (Polanyi, 1966) Thus knowledge and understanding cannot (generally) be conveyed to a third party, they must be acquired and developed using, and working upon, information as the "raw material" from which they may be created, restructured and modified. (Baumard, 1999) Knowledge creation requires creative individuals and an *"enabling context or knowledge shared space, be it physical, virtual or mental that encourages and nurtures participation and fosters emerging relationships."* (Von Krogh et al, 2000)

BPE, and the approach taken to develop it, is consistent with the Fundamental Principle of the Hermeneutic Circle. Shared understanding and alignment of interests in relation to a complex whole is developed through dialectic about the nature and meaning of its parts and their interrelationships, driven by the tacit foreknowledge, pre-understanding and pre-conceptions of strategic work groups. A focus on systems, together with their dimensions, interactions and lifecycles promotes focused debate over the 'natural' and the 'artificial', the 'hard' and the 'soft', the 'concrete' and the 'abstract' the 'physical' and the 'social'. The purpose of this debate is to increase knowledge and improve understanding in support of actions that serve the coalition of organisational stakeholders in their (systems related) *"life activities"*. In this way the methods, tools and techniques of Business and Management, Information Systems Development and Systems Thinking are combined in an approach that is both systemic and systematic.

A SYSTEMS APPROACH TO BUSINESS PROCESS EVOLUTION

The first sentence in one of the seminal works on structured programming states that *"The beginning of wisdom for a programmer is to recognise the difference between getting his program to work and getting it right."* (Jackson, 1975) Unlike the method of structured programming, Business Process Evolution (BPE) takes correctness as largely unknown, recognises that there may be many different views of what might constitute a good system, adopts a complex, pluralist position and seeks incremental improvement through learning, negotiation and compromise. For BPE the beginning of wisdom is to recognise the difference between trying to *get it right* and *making things work*.

Contribution to Practice

Human activity systems are complex, self-regulating and adaptive. (Maturana & Varela, 1987) So too must be the systems by which change is planned and managed. Self-generated, self-organised, evolutionary change processes enable systems to adapt, evolve and improve as circumstances, perceptions and requirements change. For successful business process evolution, the consideration of change and its effects must necessarily be analysed and interpreted at more than a single level and in more than a single dimension, in many (interleaved) cycles of exploration, understanding and change.

Developing a shared appreciation, among a coalition of organisational stakeholders, of "the best way forward" fosters and enables improvement in complex organisational systems. Such a shared appreciation requires a framework that promotes and supports teamwork, synergy, mutual understanding and conflict resolution, in order to support a fusion of horizons.

Founded upon the notion that organisational effectiveness is difficult to define, often unknown and generally a moving target, BPE recognises that there may be many different, and equally valid, views of what might constitute “organisational improvement” and how such “improvement” might be sought. BPE adopts a complex, pluralist position and seeks incremental improvement through learning, negotiation and compromise, recognising the importance of IT, IS and IM as integral parts of the broader business system. BPE supports a variety of technologies, tools, techniques and approaches from the domains of Business Analysis and Information Systems, to support exploration, understanding and change, using principles of method from both the hard and the soft paradigms.

The framework for BPE is a multi-perspective, multi-layered systemic approach, using a combination of top-down, outside-in & bottom-up, inside-out perspectives and "below the line" models. Systems may usefully be modelled, using the same general framework, to describe:

- what was/is or seems to be
- what could or might be
- what should or is intended to be

for each relevant system and within the framework of a web of systems, each of which may be described in similar manner as felt appropriate and useful. In this model the "systems lifecycle" is not a linear process of production, but an ongoing set of processes spanning the whole life of the target system, where correction, modification, adaptation and improvement are more important than first-time production.

Handling "Complexity"

In BPE, the consideration of organisational change is addressed through consideration and appreciation of each relevant system, together with the sub-ordinate, co-ordinate and super-ordinate systems that constitute, influence and contain it. Consideration and appreciation is encouraged and enabled by a process of questioning and dialectic debate focused on the six key dimensions: Structure, Process, Resource, Environment, Strategy and Culture. BPE provides a framework for the conceptualisation of both a target system and its means of development, affording explicit recognition of each model's purpose and status. This systemic consideration is necessary in order to determine how best to influence process, and in order to understand the processes by which the fit between each system and its environment can be improved. (Choi & Karamanos, 1998)

A variety of tools, techniques and methods may be used to model the six key dimensions of a system as a quasi-independent entity at any stage of its "lifecycle". Their selection is dependent on the scope and nature of the modelling activity, the purpose to which the model is to be put and the knowledge and preference of the architect(s) and user(s). The links between the various dimensions, perspectives, models, tools and techniques are entirely dependent on the ability of the people involved to create, perceive and interpret them. This ability is at first dependent on the pre-understanding and experience of those involved in the management of the change process and then improved and extended through successive cycles of exploration, understanding and change. In this way the process of conceptual design is firmly established in the design context, drawing upon and improving the "self-conscious" and the "unselfconscious" design capabilities of the participants. Brooks ' proposal that the essential difficulties of software development may be ameliorated (to some extent) by the development of great conceptual designers is echoed here, with one important distinction. For Brooks, the great conceptual designer is seen as possessing a talent or skill that is independent from a locus of application. For BPE, design is a process, enabled by systems, that should evolve and improve in order to fit their context better. The capability of these systems should not, and cannot, be dependent upon the transferable skills of a designated "design expert" but is an emergent property of the design process in action.

Addressing "Conformity"

BPE supports the "aligning of interests" and "sharing of horizons" at multiple levels, especially in relation to the interaction between different stakeholder groups and "their systems". The alignment of interests, and the dissolution of conflict, is sought through participative and iterative design and redesign by carefully (and explicitly) constructed "strategic work groups". Strategic work groups should contain an appropriate mix of skills and experience, so as to provide for; vision, creativity, skill in design, specialist knowledge, critical reflection, communication and conflict resolution. These are seldom (if ever) present in any one individual but may be found in an eclectic group and harnessed in pursuit of common "understanding" and "agreement". (Earl, 1990; Feeny, 1997) Strategic work groups "own" the responsibility for conceptualising, assessing, developing, producing, using, supporting and retiring "their" systems. Knowledge, skills, experiences, responsibilities and viewpoints are surfaced and debated in such a way as to facilitate the alignment of interests and the dissolution of conflict within the work group, with other work groups, and within the overall context of the problem domain.

Supporting "Changeability"

Conventional Information Systems Development methods view organisational change as largely externally driven, pre-determinable and technically orientated. However, organisational change brings with it; benefits and problems, order and disorder, opportunities and threats, understanding and confusion. Change may have a specific (perhaps-technical) focus upon which it is initially centred, but frequently spreads to many aspects of the system(s) being changed and to other inter-linked systems. Thus the consideration of change and its effects has to be analysed and interpreted at multiple levels and in multiple dimensions if the effects of change are to be "managed".

The BPE approach provides a framework in which the interrelatedness of critical components in the social setting may be considered. Self-generated, self-organised and emergent, evolutionary processes are developed and adapted so as to manage change and harness organisational capability through teamwork, synergy and a framework and strategy for dealing with conflicting roles, goals, values and viewpoints.

Countering "Invisibility"

For Brooks the inherent "invisibility" of software systems lay in the lack of physical or otherwise tangible models, and in the degree to which the form and function of software products are separated from the day to day activities of architects and users. An architect of the built environment may have explored thousands of buildings and seen tens of thousands, in the course of his or her everyday life before designing one. Models used by the building architect are very close representations of the finished article, convey a relatively small set of (largely physical) design characteristics and (other than aesthetic qualities) are largely hierarchical in nature.

To some extent, the models of systems engineering help to address the problem of software invisibility. By providing a set of architectural blueprints for a target system, they specify systems structure and behaviour, either as it is or as its designers want it to be. Use of method provides a template to guide the design process, and design decisions may be captured by the models employed. The use of generally known models and methods helps to support the development of precise and unambiguous systems specifications, through clarity in communication and rigour in development. The tools, techniques and methods of systems engineering, however, are largely representative in nature - that is to say, they describe the outcome of investigation or design; often in a linear framework and with a technical bias. Largely concerned with the modelling of mechanistic aspects of organisational activity and with data or structured and symbolic information, they are much more closely aligned to the technical components of a system and the interrelationships between them than they are to human activity. BPE seeks to model multiple systems dimensions in order to support focused debate through which to surface issues, problems, conflicts and requirements. In so doing the knowledge and understanding of the model architect(s) and user(s) is enhanced. The cycle of dialog, critical reflection and self-conscious action helps to counter the intangibility (invisibility) of organisational systems.

Supporting Organisations in the "New World of Business"

The "New World of Business" is uncertain and largely unpredictable. Goals, objectives and "good practice" are constantly in flux for many organisations and accordingly, emphasis has shifted from "doing things right" to "doing the right things." BPE provides support for organisations operating in this uncertain and unpredictable environment by encouraging working practices to become the subject of continuous active enquiry by human actors engaged in continuous assessment, adjustment and realignment of goals and objectives, working practices and information and technological systems.

In BPE processes are not assumed to be (and thus not modelled as) stable, straightforward and formal; designed and optimised through the application of rational and logical criteria, but rather flexible, complex and frequently informal; best evolved through negotiation and compromise. The human actors within the organisation are viewed as political beings with values, standards, beliefs and needs as well as experience, skills and abilities. Technology and systems are taken to be far more than simple, politically neutral, enabling mechanisms. Rather they are complex and value-laden entities; enablers of change and tools of great political power; liberating and elevating for some and oppressive for others.

By addressing these issues head-on BPE helps to close the "gap" between 'hard' rational design and 'soft' political reality and to ameliorate the problems 'within,' 'among' and 'between' organisational actors. (Valusek & Fryback, 1985)

The "availability heuristic" is problematic for linear "one-off" requirements capture, because the fact that something is readily called to mind does not necessarily mean that it is of any great importance, or that it occurs with any great regularity. This difficulty is further compounded by the tendency of humans to support their ready-to-mind theories by detecting and remembering confirming, rather than disconfirming, evidence, and to generalise from small samples. BPE encourages the long-term multi-perspective, multi-dimensional and evolutionary development of requirements and the means of their satisfaction. Predictions and assessments are still affected by the mental starting point of each participant, but their knowledge and understanding as well as their recommendations and requirements are surfaced and developed, rather than sampled and captured.

The satisficing principle (Simon, 1956) is not only recognised by BPE, it is central to its application, as in order to benefit from exploration, understanding and change, there must be regular and appropriate transfer from each of these to the others.

The competition for resources, fuelled by conflicting objectives among stakeholders and stakeholder groups is addressed explicitly by BPE, through learning, negotiation and compromise, in order to determine "the best way forward" for the organised coalition.

Obstacles between user groups and stakeholder types are overcome by a conscious and concerted effort to improve the understanding of each through the application of a framework that promotes and supports a fusion of the contexts of interpretation between the groups, communities and cultures involved. The differing frames of reference, values, standards and psycopathologies represented are viewed as a potential source of strength, rather than an

inherent weakness, in that through them the "horizon of possibilities" is broadened and the mix of capability, knowledge and understanding enhanced.

Human activity systems, the models that describe them, the process that impact and change them and the rationale for change are fundamentally interconnected with one-another. Communication, and interaction within among and between participants, in relation to each of these interconnected elements, is crucial to BPE, so as to develop a shared understanding of what to do, how to do it and why it should be done.

In a very practical sense BPE also provides support for each of the (ranked) project success factors highlighted in the still often quoted Standish Report on project failure. (Standishgroup, 1994)

Project Success Factors (ranked)
User Involvement
Executive Management Support
Clear Statement of Requirements
Proper Planning
Realistic Expectations
Smaller Project Milestones
Competent Staff
Ownership
Clear Vision & Objectives
Hard-Working, Focused Staff

Figure 5: Supporting Project Success Factors

In BPE the notion of *user involvement* is replaced by a focus on participant commitment and commitment to the participants, through a focus on the human activity systems in "real-world" practice. The problems of conformity are not ignored by reducing the richness and variety of systems requirements to the generic needs of a stereotypical "user". Rather, conflicting objectives and requirements and the ensuing competition for resources, are addressed directly. In this manner "obstacles among" participants are negotiated, through systems and methods intended to support conflict resolution and consensus formation.

Executive management support is a prerequisite for BPE. Support from all levels of management is required, necessarily including the executive, because of the radical change required in the emphasis, focus and practice of change management. Where systems evolution and development requires a concerted focus on the interaction with, and consequences of change for, co-ordinate and super-ordinate systems, the strategic implications of change are neither prescribed, nor are they certain. Thus the debate over desirable and feasible change, and the effects of change made, must radiate from the system of focus and reverberate throughout the organisation.

The Standish Report found that the likelihood of project success was increased significantly where it was based on a *clear statement of requirements*. Where there is a clear, definitive and agreed statement of requirements and project activity is genuinely directed towards its satisfaction, then all participants are working towards an explicit and common set of goals. Under these circumstances, if we achieve what we said we would, then we get what we want. However, many organisations embark upon, or recognise the need for change, without a clear, definitive and agreed set of requirements or a plan of action. BPE helps to provide a different and more flexible locus of control through the deliberate evolution of requirements, systems and the methods and means of their development. *Proper planning* is also facilitated through BPE, which provides a framework within which to plan and manage change.

A shared (negotiated, articulated and agreed) set of expectations, within and among strategic work-groups helps to ensure that participants have *realistic expectations*. In this way the scope, impact and intended outcomes of the change process are less likely to be exaggerated or misunderstood. The cycle of exploration, understanding and change involves an explicit and detailed deliberation over "the best way forward". This ensures that the nature and purposes of change are properly considered by interested parties, who are therefore less likely to simply assume that their own private vision of improvement will be realised.

Small milestones linked to organic change, with constant and continuous review cycles help to prevent "project drift". Each milestone is undertaken with a view to increasing organisational, and individual, learning and understanding, thereby developing the knowledge and *competence of the human actors*.

Explicit *"ownership"* of systems by strategic workgroups and negotiated agreement of the "best way forward" helps to bring forward and illuminate *clear organisational visions and objectives* through the explicit consideration of each system's strategy and the implications of that strategy for subordinate, co-ordinate and super-ordinate systems. Systems "ownership" also helps to develop *hard-working and focused staff* through an explicit and structured approach, which yet affords the opportunity for participants to realise Maslow's "higher order" needs of growth and self-actualisation.

Concluding Remarks

One of the primary features of the research on which this paper is based was to explore the potential for combining Checkland's Soft Systems Methodology (SSM), and the more formal methods normally applied to conventional systems engineering activities. The fieldwork illustrated that the notion that one can move from one paradigm to another by "easy stages" is fundamentally flawed. The Soft - Hard "paradigm shift" is found to be the product of (often intense) intellectual effort. The paper asserts that the link between hard and soft methods and models lies not in the mechanistic transformation of one set of models into the other, nor in the grafting or embedding of methods and approaches, but in their contribution to understanding, especially during the move from exploration and debate to action in the problem situation.

The BPE approach is founded upon the collaboration of people involved in the area of concern; a process of critical enquiry; a focus on social practice; and a deliberate process of reflective learning. BPE is systemic in nature, systematic in its coverage and pragmatic in its application, allowing a balance to be struck between creativity and control. Focusing on enabling systems, rather than on methodical phases, BPE views organisational change as systems based rather than project based. It recognises that change must necessarily be planned for and managed, but is systemic rather than formulaic.

Accordingly, it is the movement from exploration and debate to action in the problem situation that constitutes the most important shift in BPE. The alignment of interests, and the dissolution of conflict, through participative and iterative design and redesign is informed by the models and methods used, rather than being constrained and driven by them. The models used are thus seen as far less important than the views that are taken of them and the purposes to which they are put, in support of the exploration and understanding of human activity systems and their interactions, through dialog, critical reflection and self-conscious action.

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