DEPARTMENT OF MATHEMATICAL AND COMPUTING SCIENCES

TWO RESEARCH ASSOCIATE POSTS

EU Framework V funded project: Intelligent Support for People Orientated Business Process Re-engineering (INSPIRE)

30 months fixed-term

We wish to appoint two Research Associates to our European Union Framework V funded project on Intelligent Support for Business Process Re-engineering. INSPIRE is a collaborative project between Goldsmiths College, University of London and a number of European companies.

INSPIRE aims to apply techniques of representation and reasoning to the problem of business process re-engineering (BPR) to create a system that allows process views, automatic workflow generation, dynamic simulation and quantitative performance indicators, into which will be built a number of innovative features designed to render the BPR process accessible to non-experts and to support the implementation of re-designed processes.

You will have graduate level qualifications (or equivalent) in Computer Science or Artificial Intelligence (a PhD would be an advantage), together with good programming skills, and have the potential for research in formal representations and natural language interfaces.

Salary is on spine point 6 of the Research 1A scale; £20,319 per annum (inclusive of £2,134 per annum London Weighting Allowance) subject to qualifications and experiece.

Ref: 00/57A

Further details are available on the web (`www.mcs.gold.ac.uk/inspire/`) and from the Personnel Department, Goldsmiths College, University of London, New Cross, London SE14 6NW, (telephone 020 7919 7999, email `personnel@gold.ac.uk`), to whom applications should be sent in the form of a Curriculum Vitae, including the names and addresses of three referees.

Informal inquiries are also welcome, and may be addressed to Dr. Chris Fox (telephone 020 7919 7856, email `C.Fox@gold.ac.uk`), Department of Mathematical and Computing Sciences, Goldsmiths' College, University Of London, New Cross, London SE14 6NW.

Closing date: Friday, 11th February 2000. Interviews are expected to be held in the week commencing 28th February.

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Applications are invited for the above post for which further particulars are attached.

Salary is on spine point 6 of the Research 1A scale; £20,319 per annum (inclusive of 2,134 per annum London Weighting Allowance). The appointment salary level will be according to qualifications and experience.

The conditions of service and terms of appointment will be those normally relating to Research staff.

THE APPLICATION PROCEDURE

There is no application form. Candidates for the post should apply by letter (addressing the person specification, given on page 3) and attach a Curriculum Vitae in which details of their qualifications and experience are set out as listed below. This application should be accompanied by a completed equal opportunities form.

1. Full name and title
2. Address, telephone number (day and evening), fax and email contact (please state which contact is personal)
3. Date of Birth
4. National Insurance Number
5. Education with dates: University and/or professional training including full details of degrees, diplomas, certificates etc.
6. Present appointment, if applicable, with salary
7. Other experience, if applicable, with dates
8. The length of notice required for leaving present employment, if any
9. Names, addresses (and telephone and fax numbers if possible) and descriptions of three persons to whom reference may be made - one of whom must be your current or most recent employer. Please note that we usually contact referees before candidates attend interview unless you state otherwise
10. How you learnt of this vacancy; if through a publication please state which one
11. Nationality and if you are a non-EEA Citizen whether a work permit will be required, and whether you require visas to visit member states of the European Community
12. If you consider yourself to have a disability relevant to the performance of the duties described in the job description, please give details of any equipment or adaptations that will assist you to meet the requirements of the post

Applications should be sent to the Personnel Department, Goldsmiths College, University of London, New Cross, London SE14 6NW.

Please quote reference: 00/57A

Closing date for receipt of completed applications: **Friday, 11th February 2000**. Interviews are expected to be held during the week commencing 28th February.

If you have not received an invitation to interview within six weeks of the closing date you should assume that you have not been successful on this occasion.

Goldsmiths seeks to promote equality of opportunity in all its activities

THE DEPARTMENT

The Department offers an undergraduate degree in Computing and Information Systems and various degrees involving Mathematics, Computer Science, Information Systems and Statistics. The Department has an excellent reputation for encouraging students from a diverse range of backgrounds to study at both postgraduate and undergraduate levels and prides itself on its teaching quality.

The Department is the academic leader for the two B.Sc. degree programmes in Computing and Information Systems and Mathematics, Computing and Statistics for students of the External System run by the University of London. The Department is responsible for much of the organisational aspects of these programmes, study materials, syllabus and programme development, examinations, coursework, etc. Two academics in the Department act as Programme Directors, Dr David Brownrigg (CIS) and Mrs Carol Whitehead (MaCS) who are supported by a part-time (0.5 fte) External Programme administrator. Currently, about 2,000 students are registered for these degrees and the numbers are rising yearly. There are also a number of MPhil/PhD students.

The Department has at present four professors, one reader, three senior lecturers, eleven lecturers, a Systems Administrator; an Academic Administrator and a part-time External Programme Administrator. Two secretaries (one full and one part-time) staff the Departmental Office. Further details on the Department, its staff and their research interests, and the INSPIRE project are presented in Annexes A, B, C and D respectively.

The department's web pages can be found at `www.mcs.gold.ac.uk`.

THE POSTS

The posts are part of a European Union Framework V funded project on Intelligent Support for People Orientated Business Process Re-engineering. INSPIRE is a collaborative project between Goldsmiths College, University of London and various European companies.

INSPIRE aims to apply techniques of representation, reasoning to the problem of business process re-engineering (BPR) to create a system that allows process views, automatic workflow generation, dynamic simulation and quantitative performance indicators, into which will be built a number of innovative features designed to render the BPR process accessible to non-experts and to support the implementation of re-designed processes.

More details of the INSPIRE project are given in Annex D.

THE PEOPLE

Person Specification

You will have:

- graduate level qualifications (or equivalent) in Computer Science, Software Engineering or Artificial Intelligence (a relevant postgraduate degree and/or PhD would be an advantage);
- the potential for research in problems involving formal representations and reasoning;
- excellent organisational and communication skills and the ability to co-ordinate, plan and prioritise work;
- persistence, attention to detail and the ability to work efficiently to deadlines under pressure, effectively prioritising workloads where necessary;
- flexibility and initiative and the capacity for developing the post in a way that will provide maximum benefit to the department and the project.

You will be expected to:

- attend technical meetings with other consortium members in various member states of the European Union;
- liase and co-operate with other consortium members;
- carry out the agreed programme of work to the best of your ability.

Although not required, knowledge of German, Dutch or Italian might also be an advantage.

ANNEX A

Profile of the Department of Mathematical and Computing Sciences

The Department teaches B.Sc. degrees in the following subjects:

Computing and Information Systems;

and various programmes involving computing, mathematics and statistics:

Mathematics;

Mathematics with Computer Science;

Mathematics and Computer Science;

Mathematics with Statistics;

Mathematics and Statistics;

Computer Science and Statistics;

Statistics, Computer Science and Applicable Mathematics;

Computing, Statistics and Operational Research for Business.

The Computing and Information Systems degree serves the international need for graduates educated in the theory, techniques and good practice of information technology in organisations. Introductory courses in computing, software engineering and information systems lead on to more advanced topics including the decision support and management of information systems, communications and multimedia. The degree programme consists of three levels. Levels I and II are designed to provide the foundations and level III includes a compulsory project and a number of options which may include Artificial Intelligence, Neural Networks, Software Engineering Management, Human Computer Interactions, Information Systems Management, Decision Support and Executive Information Systems. Over half the students recruited each year are registered for this degree.

In most of the other programmes, a common first year (one quarter of which is comprised of Computer Science) leads to a choice of routes into the second year, according to the degree programme, while the third year consists of a range of options of which about 15 are offered each year. In addition, the Department offers joint B.Sc. degrees with Psychology, and carries out some service teaching in Computing and Statistics for the department of Psychology.

Planned developments include masters degrees in Information Systems and Computer Science. The Department administers the University of London Degrees in Mathematics, Computing and Statistics and in Computing and Information Systems for the External System; it also participates in the inter-collegiate M.Sc.

The Department has 19 academic staff, of whom 10 work in Computer Science/ Information Systems, while 6 are Mathematicians and 3 are Statisticians.

The Department maintains two computer laboratories for exclusive use by students of the department. The present equipment includes 60 networked PCs running Windows95, together with two UNIX servers that provide X-clients for the PCs. These laboratories and the computing equipment of the staff of the Department are administered and maintained by the Departmental Systems Administrator. The College Computing Service also maintains four laboratories with PCs, Macintoshes and terminals for general use.

The Department's current research strengths are in Combinatorics, Functional Analysis, Statistics, Computer Science and organisational impacts of information systems.

There are currently eight full-time and two part-time M.Phil./PhD. students, in areas spanning the range of the department's interests.

Mathematical and Computing Sciences is located in a pair of pleasant Victorian houses on the main College site at New Cross. Good transport links are available to the City, the West End, Docklands and the South and South-East of London.

The majority of staff in the department have their individual offices equipped with Pentium PCs running DOS, Windows and/or a PC based UNIX such as Linux. They are connected via Ethernet to the College's mainframe and, through the latter, to the London Metropolitan Area Network, superJANET and the Internet.

The College has a no smoking policy.

ANNEX B

List of Staff in the Department

Professor Nelson Stephens (Head of Department)

Professor Bill Jackson

Professor Cho-Ho Chu

Professor Philip Powell

Dr Lawrence Pettit (Reader)

Dr Richard Donnison (Senior Lecturer)

Dr David Brownrigg (Senior Lecturer) (Director of External BSc CIS programme)

Dr Jasna Kuljis (Senior Lecturer)

Dr Lilian de Menezes (Lecturer)

Dr Chris Fox (Lecturer)

Dr Mark Harman (Lecturer)

Dr Rob Hierons (Lecturer)

Dr John Howroyd (Lecturer)

Ms Kathy Miller (Lecturer)

Dr Ida Pu (Lecturer)

Dr Roger Sugden (Lecturer)

Mr Marian Ursu (Lecturer)

Mrs. Carol Whitehead (Lecturer)

Mr Matt Bernstein (Systems Administrator)

Ms Laura Barsi (External Programme Administrator)

Ms Hayley Frapwell (Administrator)

Mrs Raija Savage (Secretary)

Ms Isabelle Seale (Secretary)

ANNEX C

The Computing and Information Systems Group

The Computer Science group is a rapidly growing part of the Department and covers a variety of research areas and backgrounds which embrace databases, formal methods, software testing, software engineering, algorithms, cryptography, artificial intelligence, graphics and natural language processing. Research links are actively encouraged with other parts of the Department including the Combinatorics and Statistics groups.

Staff also have research links with other academic institutions including the Open University, and Bournemouth, Brighton, Bristol, Durham, Glasgow, Essex, Glamorgan, Heriot Watt, Liverpool, Manchester, Sannia (Italy) South-Western Louisiana (USA), Strathclyde, York and Zaragosa (Spain) Universities, Cranfield RMCS, the Center for Advanced Computer Studies and Loyola College Maryland (USA). Practical focus is provided through ties with industry, including BAe, BMT, BT, DRA, TSB and Daimler-Chrysler.

Regular seminars in Computer Science are held which help to stimulate research; the seminars are attended by both staff and postgraduate students. Presentations are given by members of the Department as well as by guest speakers from other institutions.

Staff

Dr Chris Fox: <C.Fox@gold.ac.uk> (Formal Semantics, Computational Linguistics, Philosophical Logic, Slicing.)

Dr Mark Harman: <M.Harman@gold.ac.uk> (Slicing, Transformation, Testing and Genetic Algorithms.)

Dr Rob Hierons: <R.Hierons@gold.ac.uk> (Software Testing Formal Specification Languages, Finite State Machines Software Reliability, Slicing, Graph Theory, Matroid Theory.)

Dr Jasna Kuljis: <J.Kuljis@gold.ac.uk> (Human Computer Interfaces. The design of graphical user interfaces. The usability of interactive computer systems. Visualisation and visual programming.)

Mr James Ohene-Djan: <J.Ohene-Djan@gold.ac.uk> (Adaptive hypermedia and hypertext. Adaptive tutorial Systems. Hypermedia programming. Multimedia Systems development. Advanced Internet Programming. Relational databases. Interactive programming.)

Prof Philip Powell: <P.Powell@gold.ac.uk> (Organisational implications of Information Systems, decision support and expert systems, risk analysis, Information Systems strategy and evaluation.)

Dr Ida Pu: <I.Pu@gold.ac.uk> (Efficient Algorithms, Randomised, Sequential and Parallel, Probabilistic Algorithmic Analysis, Data Structures, Networks and Communications.)

Prof Nelson Stephens: <N.Stephens@gold.ac.uk> (Heuristic algorithms for computationally hard problems; Algorithms; Computational number theory; Cryptography.)

Mr Marian Ursu: <M.Ursu@gold.ac.uk> (Intelligent Design Assistants, Knowledge Based Systems, Knowledge Representation/Engineering, Spatial Reasoning, Logic, Logic Programming, Behaviours of Intelligent Systems (Interaction with the User).)

ANNEX D

The INSPIRE project

Project Summary. The INSPIRE project will build a BPR support toolset comprising a base of IDEF-type process views, automatic workflow generation, dynamic simulation and quantitative performance indicators, into which will be built a number of innovative features designed to render the BPR process accessible to non-experts and to support the implementation of re-designed processes. A natural language front end will be built to allow a user to enter process data without being forced to draw boxes, arrows etc. Iconic process representations will be used to make formal diagrams more intuitively understandable. Explicit information on skills required and available will be associated with diagrams. The simulation module will feature fuzzy, qualitative performance indicators besides standard numeric ones. Dynamic simulation of processes will be animated to make them comprehensible to non-specialists. At the core of the tool, generic formal process models will used to represent process data, allowing coherence between different views to be enforced, and supporting diagnosis and explanation features. An implementation planner will be developed to support the change process, built on a case based reasoning engine and a library of BPR best practice. This module will provide explicit information about the skills and personnel available and required for the change, set realistic milestones and targets for the changeover period, as well as provide criteria for the evaluation of a newly implemented business process.

Description of work. INSPIRE will run for 30 months. The consortium contains two major manufacturing end-users (a shipyard and a steel cord supplier), two management consultancies who are specialists in BPR and three software providers. The first period covers software specifications and user requirements. Market Intelligence is also undertaken during this period. Throughout this period, the software partners will communicate frequently with the end users, so that the specifications for the software modules can be built in the same time frame. Thereafter software prototypes are built taking account of the results. At the same time, the consortium's initial exploitation plans are drawn up. These plans will be updated and revised throughout the project. Once the requirements and specifications are drawn up and agreed, system integration will take place in the business premises of the software partner (TXT) responsible for technical coordination and quality assurance. During system integration, and as soon as a usably stable prototype can be released, the first pilot BPR initiatives begin and run for 6 months. These comprise real BPR activities using the INSPIRE tool and approach in both manufacturing end user sites, each supported by a consultancy. The end users will test and validate the tool and supply feedback to software partners on errors, usability, functionality, robustness and performance. From this point, seminars and demonstrations are performed to interest potential customers and gather feedback. Software refinements will be undertaken during the first BPR pilot, and will comprise corrections to and extensions of the software resulting from end user feedback. The second field trials start immediately after the first have been completed. These take the same form as the first trials, but are longer and more extensive reflecting the advanced development status of and improved end user expertise with the tool. Throughout this period there will be a constant cycle between end users and software partners of feedback and successive new releases of the tool. The end users will produce a User Manual for the tool forming the basis of the documentation for the commercial system. A workpackage follows, dedicated to software finalisation and product, focussing final product package definition and the performance and look-and-feel of the tool ready for commercial exploitation.

Milestones and expected results.

- MS1 month 7: User requirements, software specs. complete. Market Intelligence.

- MS2 month 13: Software prototyping done. Tool stable, ready for pilot studies. Initial Exploitation Plan. Consortium Agreement signed.
- MS3 month 19: First BPR field trial complete. Draft Handbook. Full tool functionality implemented, ready for extended field trial.
- MS4 month 25: System complete in all respects.
- MS5 month 31: Extended BPR trials complete, software, documentation, product package ready for roll-out.

Project Objectives.

Introduction. Business Process Re-engineering (BPR) enables an organization to evaluate current processes with the goal of radically and structurally revising those processes to accommodate changing organizational needs and goals. BPR can dramatically enhance a business' competitive performance in a variety of ways: increased efficiency, improved profitability, better management and distribution of resources and better deployment of people and their knowledge. Equally important, a successful BPR initiative can result in a more challenging and rewarding culture in the workplace. Unfortunately BPR studies are difficult, expensive and time-consuming. Worse, it is estimated (Hammer and Stanton 95) that two thirds of BPR efforts either cost more than they save, are never implemented satisfactorily, and/or fail to meet their hoped-for outcomes. As Hammer and Stanton point out, people play a fundamental role in the success of any redesign of business practice, and one of the major reasons for the low success rate of BPR initiatives, (and a serious shortcoming in existing BPR support tools) is the failure to take this "human factor" into account:
At the process analysis and design stages. A key issue in the preliminary stages of a BPR project is the ability to communicate and to share views and ideas among the participants of the (possibly distributed) project teams. At this time a consultant will conduct a cycle of interviews and analysis and formalisation sessions. This process requires the involvement of people from the client organisation who will have varying backgrounds, skills, roles and responsibilities. A participative approach to this phase of a BPR study, facilitating inter-functional communication and the sharing of concepts among people with diverse culture, experience and business background is of fundamental importance for the chances of success.
At the process implementation stage. During the period when new processes as designed by the BPR team are being implemented, peoples' roles and responsibilities will be changing, as will their skills and information requirements. There is a danger in BPR that the new process will fail at this point, owing to inadequate support for and management of the change.
At the process running stage. Once a new business process has been implemented, its continuing successful performance depends on ongoing management, sustained motivation and reliable performance evaluation techniques.

In order to provide a credible baseline against which to assess the project's success in these respects, the consultant partners and end users will evaluate from past experience the expected time and costs of the BPR to be undertaken in this project so it can be contrasted with the actual results achieved. This task will be complicated by the fact that in the process of developing a new toolset, time will be given over to evaluating the software and approach as well as to BPR itself.

Equally importantly, there are ethical considerations associated with re-organisation of business practice since the lives of real people are strongly affected by change. The INSPIRE project will develop a support tool and associated methodology which will address these issues, by providing real help with all stages of the BPR process, and incorporating extensive new features to take account of the human factor as outlined above. The consortium includes two BPR consultancy partners, who besides being skilful process engineers

also provide expertise and experience in these human aspects, ethics, cultural changes, change management etc..

Objectives. The fundamental target of the INSPIRE project is to dramatically increase the chances of organisations undertaking successful, cost-effective and fair BPR activities. This overall goal is not a quantifiable objective, although it is easy to see that if the INSPIRE tool can make the difference between success and failure, the potential impact of INSPIRE is huge. More specific and quantifiable business and technical objectives can be set out as follows:
Quantifiable Business Goals. We take as a reference a "typical" BPR study, with costs realistically estimated by appeal to i). the consortium partners who have extensive experience in BPR (the consortium includes two large industrial end-user partners, two management consultancies, specialists in process re-engineering, and two software developer partners with extensive experience of developing major industrial decision support applications); ii). a survey conducted through the World-Wide BPR forum; and iii). real cases reported in the literature (see for example Hammer & Champy 94). In what follows, labour rates are estimated at 10KEURO per man month and consultant rates at 15KEURO per man month.
Reduction of process analysis and redesign costs by 25%. Analysis requires an extensive programme of interviews, consolidation and feedback sessions, drawing people together from all aspects of the business organisation. Given a (modest) project team of 5-10 senior people, this process might easily require 20 man-months of effort. Similarly, the analysis of re-design options might involve comparable levels of effort, and often real-life trials as well. The INSPIRE tool will reduce this costs by 25% and will result in savings of 100 KEURO. Typically, consultants might be involved in these processes for between 1 and 3 man months, representing costs to the customer of between 15 and 45 KEURO, so a 25% reduction will result in savings of consultancy time worth between 3.75 and 11.25 KEURO per project, which, for a consultancy handling 50 jobs a year, this constitutes savings of between 187.5 KEURO and 506 KEURO.
Reduction of the time taken in BPR analysis and design by 25%. A (successful) BPR initiative might result in savings of 1 MEURO per annum, and could take 1 year to complete (very often they are considerably longer than this). The INSPIRE tool and approach will allow a similar BPR project to be undertaken in 9 months, resulting in a saving of 250 KEURO.
Reduction in cost of developing supporting IT infrastructure by 25%. Commissioning Executive Information Systems or Workflow projects might cost approx. 200 KEUROs, and might require significant internal investment of human resources (possibly 6 man months). INSPIRE will lay specific focus on this issue to enable 25% savings in this respect, corresponding to 65 KEUROs.
Reduction in cashflow problems in consultancy. This goal is not directly quantifiable, but in this respect INSPIRE will meet a very real industrial need: Increasingly, BPR consultants receive low fees and payment-by-results for long projects. So since INSPIRE will reduce consulting costs, shorten BPR lifecycles and decrease BPR risks, the number of projects undertaken will rise, redressing the problem.

Baseline. With a view to effective treatment of the human factor, the INSPIRE project has certain well-defined quantifiable technical goals (the degree to which these objectives are expected to be fulfilled at various stages in the project lifecycle is set out in the Milestone descriptions in the Project Workplan):
Speed and ease of use. The INSPIRE tool will incorporate features specifically designed to allow non-specialists to model processes in the tool, and to speed up the process of creating these process models for all users. It will achieve this by providing a multi-lingual (at least English and Italian will be supported in the first prototype) dialogue/menu-driven interface to the model editors (fuller description appears in section 1 "Innovation"). The consortium uses two benchmarks against which to quantify achievement of this latter objective:

- first, during analysis meetings and discussions, it is a common experience for a consultant to take notes, and afterwards transcribe these notes into (parts of) process models on a BPR support tool. The INSPIRE tool will be friendly enough to use in real time—that is, it will be possible to enter process models at note-taking speed. In quantified terms, this corresponds to the ability to enter an activity a minute for an experienced BPR practitioner.
- a non-specialist will be able to enter a simple business process (using a standard training example) made up of five key activities within ten minutes.

Incorporation of the skills factor. INSPIRE will support an extensive and complete description of the human factor. At the process analysis stage, for example, it will not only support the description of processes and resources, but also a model of the human skill requirements for performing certain tasks, and the existing skills available in-house for executing such tasks. Similarly, at the process design stage it will provide a description of the skills needed to perform a newly designed process and to identify gaps in actual skills availability and skills development needs. As a benchmark, the INSPIRE system will identify a leading commercial skills modeling and assessment package (possibly HAYES), and will model/represent a similar range of attributes (numbering approximately 80) relating to skills capacity.

The INSPIRE consortium includes two established BPR consultancies. A common observation shared by these consultants is that non-specialists do not find it easy to understand the formal aspects of BPR or BPR support tools. INSPIRE has several specific goals concerned with rendering the BPR lifecycle and IT support intuitive and easily comprehensible to non-experts. In order to set up quantitative benchmarks for success in these respects, the consultants will between them compile an extensive questionnaire, based on existing questionnaires which are used already, both to guide the development of these features and to provide a structured method with which to gather and assess user feedback with respect to the following 3 goals:

Intuitive process modeling views. Most existing tools deploy semi-formal diagram-based schemes for representing processes (organisational, functional, behavioural, informational). The INSPIRE tool will do so also, but while these may be useful tools for consultants, they are hard to understand for anyone else. As such they do not allow for a quick sharing of process models with non-experts, and they are far from being an effective medium for communication. The result is a need for extensive cycles of interviews, and separate analysis and formalisation sessions. This renders a genuinely participative approach to BPR hard to achieve, and results in long lead times in the process analysis and design stages. INSPIRE will provide a solution by developing a non-technical icon-based process view, which will allow non-experts an immediate and intuitive understanding.

Intuitive performance modeling. Many tools offer performance analysis and simulation feature(s) as a part of their functionality, but these are invariably quantitative in nature, and usually rely on a limited set of time- and cost-related indicators such as lead-time, resource-saturation, throughput or ABC costing. These indicators require a measure of professional expertise to understand and manipulate effectively. But many important indicators of business performance are not so easily quantified, for example concepts like “customer satisfaction”, “employee fulfillment” “quality” etc. Such qualitative notions are often of much more immediate understanding than numbers, and as such their incorporation is a specific objective of INSPIRE. This feature will be of particular value in gathering initial consensus around new ideas during process design, making the purpose and value of BPR available and attractive to all concerned, expert and non-expert alike.

Intelligent help and advice. While state-of-the-art BPR tools feature a variety of views and indicators for processes and performance, they deploy only limited coherence checking—there is normally no explicit connection between different types of view. INSPIRE will have one underlying central representation of processes and performance, built according

to principles borrowed from Artificial Intelligence (details in section 5). The intention is to build representations of process models which are generic enough that particular process views can be generated from these. Thus the coherence between views will explicit and enforced, and intelligent advice and help will be integrated across the entire tool platform (the machine will "know" if the process and performance representations in different views are mutually coherent). Moreover, existing tools focus exclusively on the "what" of a business process, providing little insight into the "why" and "how". Thus, while they capture the mechanistic aspects of a business process, they do not capture the business semantics which are an essential part of it. By contrast, the INSPIRE representation will be rich enough to allow automated answers to "why" and "how" questions.

Support for BPR implementation and change management Successful BPR does not end with the definition and acceptance of a "to-be" process. INSPIRE will provide active support for the definition of an Implementation Plan, detailing tasks and activities for real employees, and with time and resources allocation, to implement the new process. Equally important is a "Change Management Plan", giving support for the entire change process, including personnel requirements, training programmes, and a framework (including critical dependencies, milestones) for monitoring the new process once in place.

Cumulative Repository of BPR Resources. Certain features cited above rely on the compilation of certain BPR resources: the icons for the intuitive representation need to be designed and stored; the qualitative reasoning is driven by business rules which need to be compiled, and the implementation planner will exploit a database of BPR best practice cases (details of these features appear in section 1 "Innovation"). The INSPIRE software platform will include a database repository for these resources. The idea is that over time, more and more such features can be included, so that the value and scope of the tool increases with use. During the lifetime of the project, the objective is to compile and store at least 50 BPR cases, 100 icons and 200 business rules. Note that these icons will cover both pilot centres and all the processes analysed and re-engineered during the project. It is not therefore expected that a non-specialist will be expected to be familiar with all 100 of these.

To summarise, the aims of INSPIRE are to design and build a BPR tool to provide real help in the modeling and re-designing of business processes, and real help in managing the adoption of the new process, incorporating extensive support for the human factor in its many aspects as outlined here. By far the most significant objective is to provide an intelligent environment in which the change in business culture and practice which necessarily accompanies a successful BPR initiative can be managed and encouraged through the complete lifecycle of the BPR effort.

Workplan.

General Description. During the lifetime of the project, the INSPIRE consortium will develop a large and innovative software tool, and at the same time validate and use this tool in genuine field BPR projects. The essential principle behind the INSPIRE workplan approach will be the notion of rapid and iterative prototyping—that is, a procedure will be adopted in which the developer partners will release, from an early stage, successive incomplete but running versions of the toolset, and then respond quickly to user feedback with further releases; the lifecycle of the project will see a constant exchange of feedback and comments from the end-users to the development partners, and a corresponding succession of software releases. The workprogramme is divided into workpackages reflecting major components of the project effort. Every task in every workpackage will have or will contribute directly to a deliverable of the appropriate form (normally document or software), and the completion (or significant part thereof) of every workpackage is marked by a Milestone.

The INSPIRE tool. The INSPIRE tool is composed of a large number of separate, though integrated software modules. Two of the three software partners in the INSPIRE development team have considerable experience and expertise in industrial decision support and business information systems which will ensure that although the software effort in INSPIRE will be considerable, this experience and know-how will ensure that a functioning system is developed quickly, thereby allowing the End-User partners a working piece of software with which to begin field trials, and meaning that the development team are available to focus on the advanced features of the INSPIRE tool from the outset. In order to ensure the effective and coordinated development and integration of such a large tool, the consortium will appoint a Technical Coordinator from TXT. This role will be to lead and manage the software development effort. The various modules will be linked into a functioning whole at TXT's business premises.

The components of the system are described below.

Modeling Editors and Display. This component forms the most significant part of the HCI, and supplies the main graphic development environment for the INSPIRE software tool. This module will support the diagrammatic display of the various representation of process models, at the same time as allowing the user the full range of windows-based diagram drawing functionality as well as intelligent auto-formatting features to ensure the best possible display appearance. The overall design of the graphical display functionality will take place in the specifications tasks (see workpackage descriptions below)—but it is envisaged that IDEF-type diagrams will form the basis for these views. Note that these formalisms are not designed for intuitive accessibility by non-expert personnel—this latter kind of view will be overlaid on these formal representations (see Human Resource and Iconic Process Description Views below).

Direct editing will be possible in this module (drawing, cutting, pasting etc.), and connections and coherence between views will be enforced automatically, with advice to the user where required.

Human Resource and Iconic Process Description Views. These features will be overlaid onto the formal process description views described under the previous heading. The purpose is to allow icons to (possibly semi-transparently) stand in place of boxes or groups of boxes, in order to render the formal descriptions more intuitively acceptable. The Human Resource/Skills information will be superposed onto the formal views in the same way, allowing non-technical users the ability to relate the process diagrams with actual skills requirements and availability.

Process Representation Module (PRM). This module forms the "engine room" of the INSPIRE tool, and comprises one of its most innovative and powerful features. The PRM is responsible for the abstract representation of business processes in a form which will support the generation of the various concrete representation schemes which the tool will offer, make explicit the connections between these schemes, and support the more advanced simulation and Artificial Intelligence features. For this purpose, the PRM will deploy an activity-based Intelligent Agents architecture (see e.g. [Zanker 99]). Such representation schemes are powerful, flexible, and generic enough to support the design goals of the PRM Module. Detection of errors in the processes will be an advanced feature, offering immediate guidance on diagram completeness, consistency etc, but also on the coherent connections between the various process and performance views. Certain properties in particular will be highlighted, e.g. loops in chains of intentional dependencies, conflicting goals, opposing tasks, resources required in different activities.

It is important to note that the PRM will represent and manipulate all aspects of the BPR effort, including performance representation and evaluation, both qualitative and quantitative, in a centralised, formal model. The representations in the PRM will also be required to integrate tightly with the Natural Language front-end, and with the Open Model Repository.

Open Model Repository (OMR) and Access Library. The OMR is the database environment in which the business models developed in the tool are stored. The access library will allow the tool to load and save entire projects/versions, or else individual features of process models, as required, thereby supporting the smooth and friendly development of BPR activities. The OMR and its access library will also be deployed to serve as a link between the INSPIRE tool, and other tools and environments. In this sense, the OMR will be a mirror to the PRM, constituting an abstract process meta-model. The resulting coherence and flexibility of design will support the seamless and powerful integration between INSPIRE and external IT tools. In this connection, as demonstration of this feature, the consortium will develop export links form the INSPIRE tool to an Executive Information System (possibly Forest and Trees), and will investigate the possibility of links to external Workflow Engines and production simulation tools (e.g. WITNESS). Note that such data export could not contain sufficient information to drive a WITNESS simulation directly (more detail is required for a simulation package to run), but would nonetheless supply the basic parameters for such simulation.

The Simulation Module. The Simulation Module will handle process static evaluation and dynamic simulation of processes, and will provide both quantitative and qualitative performance analysis as well as process animation. To achieve this, the module will supply disambiguation functionality and automated generation of dynamic and workflow simulation from static models. Once again the mechanism to accomplish this begins with the rich abstract model in the PRM, which will have the knowledge and flexibility to generate these features. The simulation module will support a full range of quantitative Performance Indicator criteria built-in by the system (including product cost, process lead time, resource consumption etc.). In addition, the user will be allowed the freedom to define customised indictors either from scratch or by mathematical combination of existing indicators. These features are for the use of consultants and experienced BPR personnel, and will not be aimed at non-technical people.

An interface for the creation of fuzzy and imprecise qualitative performance indicators will be implemented using a fuzzy logic engine, built along the lines of an intelligent system shell (e.g. CLIPS), allowing the user to “tweak” and experiment with the indicator’s parameters: so for example, certain activities can be associated with certain imprecise effects (e.g. “quality”) in varying degree. Moreover, these indicators will be able to interact with each other (so for example a certain activity or group of activities might score highly on (e.g.) “ease of set-up” but less highly on “flexible responsiveness to customer”. In this way, competing possible processes may be compared with each other according to an unlimited set of indicators. The setting-up of imprecise and qualitative performance indicators will be a specialist’s task, but the result is intended to be immediately comprehensible to non-specialists.

The automatically generated dynamic simulations will be enriched with icons (related both to resources (documents, materials etc.) and to the process itself (stop-go signs, clocks/hourglass etc.). Moreover, the dynamic simulation will use animation. The kind of thing envisaged here is that parts of the diagrams may change colour, flash, or give messages, and simple moving animation (not unlike the emptying of a Windows Recycled Bin) will be included. The direct purpose here is to bring the workflow representation “to life” in a way which renders the simulation obvious to non-specialists.

The Natural Language Module. This module will serve two roles;

First, it will allow a non-specialist user to model business processes with (semi) natural language, with natural language feedback, and without being expert in any of the standard, formal process representation formalisms, and it will support the very fast “real-time” entry of process models into the tool, for example, actually during BPR team meetings. The mechanism for this will be “point and click” menu-driven: the user will be prompted to select the kind of process they wish to model from pre-compiled menus, given options as to how to link their models together etc. At the same time, as the user builds a representation

through this interface, their commands will be relayed back to them in natural language, allowing them to validate that what they enter is correct. When the user is satisfied, the machine will automatically create/modify the underlying process model, and the graphical representation features will be formatted and generated automatically. Of course the user is free to adjust and manipulate the models "by hand" at a later time.

Second, it will provide (semi-) natural language support for the user to enter business rules for use in the Diagnosis and Explanation Module adjunct to the simulation module (see below). In a similar fashion to entering process descriptions, the user will be prompted to link the rules as they are entered to the relevant activities.

The Diagnosis and Explanation Module (DEM). This will be attached to the Simulation Module, and will provide coherence checking facilities and expert advice on processes, as well as explanation of the reasoning performed in simulation and analysis (both quantitative and qualitative). This module is also responsible for fielding "why" and "how" questions where business rules have been associated with activities. To achieve this, the DEM will incorporate a simple Natural Language Generator, working with a canned corpus of text.

The Implementation Planner Module (IPM). The IPM comprises a case-based implementation plan generator, linked to a repository of BPR studies and best practice, an engine for configuring precisely the human requirements for successful BPR take-up (skills/knowledge/personnel/training needs), and a generator of process objectives monitoring criteria with which the performance of the newly adopted process can be realistically monitored. This module is responsible for supporting the embedding of BPR modeling and design into a real-life industrial setting. For a given business setting, it will supply a template for implementation to ensure that the implementation plan is determinate and complete, critical dependencies are in place, and realistic milestones set up.

BPR Library. This is the database in which are held the various features of the INSPIRE tool which are developed and accumulated over time (icons, business re-engineering best-practice cases, business rules). As mentioned before, the ultimate goal is that the power of the tool grows as more and more information is stored.

Goldsmiths Contribution. Goldsmiths College, University of London, contributes to the INSPIRE project as a research facility and software provider. Particular responsibilities are the design and implementation of an agent-based generic process description architecture and a Natural Language interface.