

# Mid Term Review 2000

Part 1 – Management Report

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## EXECUTIVE SUMMARY

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## EXECUTIVE SUMMARY

The report is divided into three sections. Section 1 contains management and administrative information about CRIC activities during the period, together with a summary of the business and research strategy proposed for the second five-year funding period, and the future strategy beyond year 10. In essence it provides a narrative of the development of the centre, its trajectory, and its future. Section 2 contains a fuller account of the academic work carried out to date, broken down into discrete projects, specific pieces of work, and their outputs. The work presented includes some elements wholly funded through the core grant to CRIC, some funded through other grants held in CRIC, and some areas where the work has benefited from both types of funding. These relationships between funding and output are clearly stated in this section. Finally, Section 3 contains performance indicator data in the format required by ESRC.

CRIC is a joint centre of the University of Manchester and UMIST. The primary contract from ESRC was awarded to the University of Manchester, with a start date of October 1996. A sub contract was created between The University of Manchester and UMIST which provided for 40% of the funds to be passed directly to UMIST. This UMIST funding was used to employ 3 of the initial complement of 7.5 full time researchers who were appointed to positions in the Centre

The Centre began work in dedicated offices in January 1997. At that time it had 4 Professors as co-directors, 7.5 research staff, and 2 administrative and secretarial staff. Since then research staff have increased to 12 (11 FTE), and admin/secretarial to 3 FTE. The additional staff are funded by the (approx) £700k of additional research income raise by the centre to date.

CRIC is set in the context of a broader environment of management and social science departments of the two universities, with whom it has complex and evolving relationships. The directors of CRIC have offices in CRIC **and** in their 'home' departments. This has create a good environment for CRIC staff to develop a strong team spirit with good collegial and flexible modes of working together. It has also presented CRIC with the challenge of drawing from and contributing to the great pool of expertise in the staff of the 'parent' institutions from which it was spawned. These include in particular the members of the Federal School of Business and Management:

- Manchester School of Management, UMIST (especially CROMTEC: The Centre for Research on Organisations, Management and Technical Change)
- Manchester Business School
- PREST (Programme of Policy Research in Engineering Science and Technology)
- Manchester School of Accounting and Finance

They also include the other departments of the Faculty of Economics and Social Studies in Manchester University.

Now that the distinctive identity of CRIC's intellectual programme has been firmly established, in the next stage of CRIC's life, we will pursue the integration of CRIC and the other major elements of the innovation research community in Manchester. This will be carried forward by the plans to co-locate CRIC, PREST and CROMTEC

as a result of a successful bid to the Joint Infrastructure Fund. This bid (principal applicant: Professor Stan Metcalfe) resulted in £5.7 million being awarded to the two universities to create a new research facility for the Federal School of Business and Management. The building will house three major Federal School activities, one of which will be the co-location of CRIC, PREST and CROMTEC to conduct a joint research programme on Innovation and the Knowledge Economy.

## Objectives

To assist the reader we reproduce here a statement of the aims and objectives of the Centre as first formulated in the award.

*“Major advances are expected in these areas:*

- *the study of innovation as a social, economic and managerial process;*
- *the contribution of innovation to the national competitiveness of firms and sectors;*
- *the comparative understanding of national innovation systems and their relationship to processes of globalisation.”*

## Achievements

CRIC’s principal **intellectual** achievements during the period under review are as follows<sup>1</sup>:

- The development of a new framework for analysis of innovation in modern economies which has the following four key features:
  - A deliberate focus on *service innovation*, not simply in the sense of services as a sector, but rather as a mode of innovation which is present in all sectors, and which has major consequences for theory and practice
  - An analysis of innovation as a process which is *distributed* across multiple firms and agencies, but in ways which change in a subtle way in interaction with processes of competition
  - Re-examining competition as a process which is ‘*instituted*’ (*Polanyi*) in different ways as a function of time and place; giving rise to different modes of innovation. This requires an analysis of competition *between modes of competition*, as well as within modes of competition.
  - The use of new developments in the sociology of consumption to attack from a fresh angle the conceptualisation of ‘demand’ in the innovation process.
- Substantial empirical research using both qualitative and quantitative techniques creating noteworthy results in the following areas (examples only):
  - The characterisation of knowledge –intensive business services and their contribution to productivity growth and structural change in economies
  - The use of large data sets to generate new insights concerning the nature of services innovation; the role of small firms in innovation; the relative innovativeness of UK and foreign firms in the UK; long term patterns in the evolution of patent clusters; and the existence of structural breaks in long-run productivity data.

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<sup>1</sup> Section 2 of the report provides full accounts of the research projects conducted and their outcomes.

- Using a single item – ‘the tomato’ – as an **empirical probe** to reveal a vast and complex pattern of changes in the relationships between horticulture, supermarkets, biotechnology firms, equipment and material suppliers which takes different ‘systemic’ forms in different geographical regions. This material has then been theorised using the concepts of distributed innovation and instituted competition as described above
- Demonstrating that consumption patterns and diffusion processes of new products are influenced by social class independently of income levels.

CRIC’s other achievements include:

- Publications of substantial volume and quality:
  - 23 (including 9 forthcoming) Books
  - 99 (including 33 forthcoming) Book Chapters
  - 80 (including 12 forthcoming) Refereed Journal papers
  - 52 Other publications (9 Working Papers, 39 Discussion Papers and 4 Briefing Papers)
- Development of close working relationships with colleagues in academic institutions, in government departments and agencies, and private firms, in the UK and abroad. These relationships result in our research agenda being influenced by these partners, but it also results in their research policy and practice being directly influenced by CRIC research and by the standing and advice of CRIC staff. Some of this interaction has been at very high levels in these organisations (see sections 1.4 and 1.5)
- CRIC research staff have been successfully developed by their involvement in the research. This has been shown by their internal promotions, and by the fact that three of CRIC’s staff have been appointed to permanent faculty positions in other universities.

### *Forward Plan*

CRIC has produced a forward research plan (1.7.1) and a business plan (1.7.2)

The **research plan** is built around a continuation of the programmatic work on the four themes identified above namely: service innovation; distributed innovation; competing forms of competition; and the analysis of consumption as an aspect of innovation. In addition, the plan will begin by using three major ‘probes’ for the organisation of the bulk of our empirical work. These probes are:

- Biotechnology, examining in particular the genetic modification of plants
- ICT and the e-economy, looking in particular at the development of e-commerce
- Using large data sets on innovation and labour force characteristics to re-conceptualise the relationships between innovation and the structure of economic systems.

The **business plan** is built on the consequences of the JIF award. CRIC will collaborate with CROMTEC and PREST during the period 2001-2006 in the creation of a centre of excellence in research and postgraduate teaching in Science, Innovation, Environmental and Technology Management. The actual arrangements of the new centre's organisation and activities will be set in the context of the Federal School of Business and Management of the two Universities of UMIST and Manchester. Arrangements are in place for the two universities and the Federal School partners to discuss the structure and management of this centre of excellence and agree on reporting and financial arrangements. These will be concluded in time for the three centres to move into the new JIF-funded building in early 2002. Thereafter the plan envisages the following developments.

During years 6/7 of ESRC funding, CRIC will operate within the co-located and collaboratively managed 'joint centre' with PREST and CROMTEC. ESRC core funding at this time will support the CRIC core research programme, *and thereby* will *partly* support the JIF research programme. However, the three centres will also jointly be involved in securing additional new research funding for the JIF programme. At the same time, other research topics broadly consistent with the mission of the individual centres and the joint centre will be the subject of new research projects

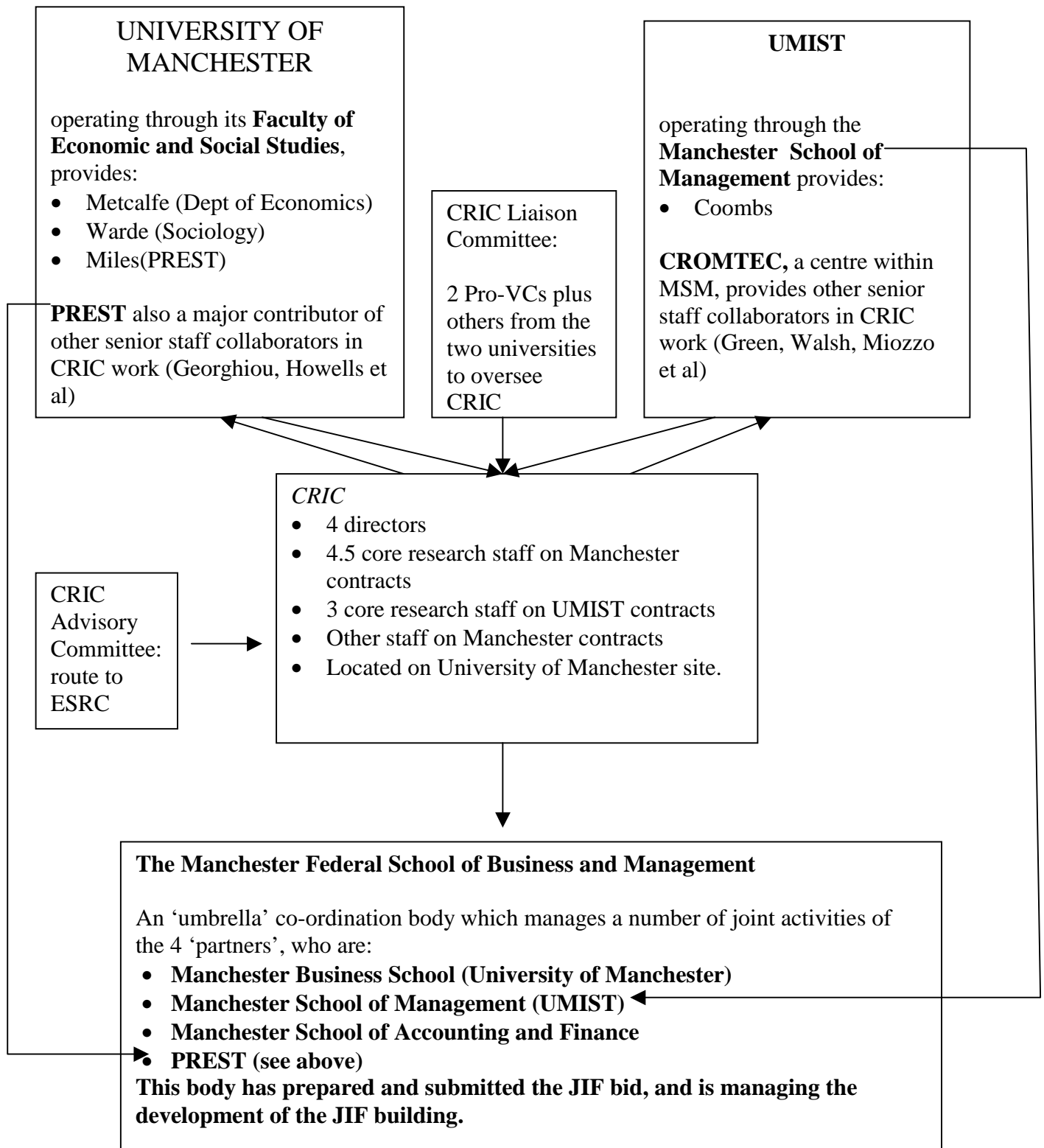
During years 7/8 of ESRC core funding, the joint-centre will mature and take on a more stable configuration. This will enable the personnel and the capabilities of the joint centre to be deployed on a variety of research activities broadly within the umbrella title of 'science, technology, innovation and environmental management'. Whilst the ESRC core funding will still be firmly linked to a clear '*programme*' of work, the resources deployed to deliver that programme may gradually change to encompass a larger group of contributing staff from the combined centre. The funding for this core programme will peak in year 8. Likewise, staff originally linked only to CRIC, may become involved in other aspects of the combined centre's work. A process of organic academic growth and development will ensue, such as one would expect in a large unit.

During years 9 and 10 of ESRC core funding, the levels of support will taper off. The intellectual issues and capabilities linked to the core programme will become more embedded in the larger joint centre. The funding of CRIC core staff will be gradually transferred to the broader research portfolio of the joint centre.

The points listed above describe a progressive overlap and engagement, in intellectual, financial, and personnel terms, between the CRIC research programme and the other research activities of the Joint Centre. *However, it is our clear intention to maintain a proper degree of independence for the CRIC programme as such.* This is vital not only to give clear accountability to ESRC, but also to defend the basic research character of the programme: to ensure it is managed in a manner consistent with that character, and to avoid it being exposed too much to some of the competing pressures which arise from shorter term contract research. This balancing act between independence and synergies with other research is one which is a challenge, but which the directors are well aware of.

In conclusion, the entire staff of CRIC are proud of achievements to date. They, and the institutional stakeholders in CRIC, believe that CRIC has an unrivalled opportunity over the next decade to make world-class contributions to the understanding of innovation and competition, and to create a centre with an even stronger reputation than it already has.

## THE INSTITUTIONAL CONTEXT OF CRIC



## **INTRODUCTION**

### **Scope of the Report**

CRIC was awarded the status of a designated research centre of the ESRC from October 1996 to September 2006, subject to a mid-term review of the first five years' performance. Terms of reference (TOR) for the review are provided by ESRC, and are reproduced in Appendix 1, together with a note on which sections of the report provide the specific information which relates to each point in the TOR.

The report is divided into three sections. Section 1 contains management and administrative information about CRIC activities during the period, together with a summary of the business and research strategy proposed for the second five-year funding period, and the future strategy beyond year 10. In essence it provides a narrative of the development of the centre, its trajectory, and its future. Section 2 contains a fuller account of the academic work carried out to date, broken down into discrete projects, specific pieces of work, and their outputs. The work presented includes some elements wholly funded through the core grant to CRIC, some funded by through other grants held in CRIC, and some areas where the work has benefited from both types of funding. These relationships between funding and output are clearly stated in this section. Finally section 3 contains performance indicator data in the format required by ESRC.

In order to allow time for the ESRC to conduct the review and make recommendations through its committee structure, the review is in fact being held at the end of year 4 in the first 5-year funding period. Consequently the material presented here covers four years' work and not five, namely October 1996 to September 2000. The centre began its operation on the 1<sup>st</sup> January 1997.

## **PART 1. MANAGEMENT REPORT**

### **1.1 Background**

CRIC is a multi-disciplinary and multi-institutional centre, which resulted from the bringing together of several related elements. This was reflected in the development of the proposals for the centre and the short-listing and approval process. Two separate proposals for a centre were originally submitted from Manchester institutions to the first round of the centres competition in October 1994. Multi-disciplinarity and multi-institutional stake-holding has continued to influence the development of the centre, and therefore it is important to take a little space to explain this background.

The first of these centre proposals was jointly developed by Professor Rod Coombs from the Manchester School of Management, UMIST, (with the involvement of several other MSM staff); Professors Ian Miles, Luke Georghiou and Stan Metcalfe from PREST in the University of Manchester; and Professor Alan Pearson from the Manchester Business School (University of Manchester). This first proposal addressed a range of issues relating to the innovation process in companies; science and technology policy; and had a distinctive focus on innovation in services. The projects it proposed correspond to the first 6 projects in the list of 7 projects which ultimately were incorporated into CRIC's eventual award [see below].

The second proposal was developed by the Faculty of Economic and Social Studies of Manchester University and Manchester School of Management at UMIST under the leadership of Professor Huw Beynon. It was also multi disciplinary, with inputs from economics, sociology, and the Business School, and it addressed the globalisation processes emerging in the economy, and the changing nature of competitive processes associated with this. A common factor connecting the two proposals was the presence of Professor Stan Metcalfe in both teams.

The (then) Centres Board of ESRC examined these two first-round proposals in the context of the national competition and short-listed them. However, it invited a full-scale second round proposal only on the basis that the two proposals be combined into one. The full proposal was submitted in the names of Metcalfe, Coombs and Beynon as a joint proposal from the two Universities, and had a large suite of projects covering the range of both first round proposals. The Board approved the proposal, but in so doing it considerably reduced the weight given to the topics covered in the second proposal. The resulting award therefore specified seven initial two-year projects [see part 2] which leaned heavily towards the issues of innovation and services, but set this issue firmly in the context of examining the relationship between innovation and changes in the nature of competition, in an international comparative context. This intellectual portfolio was reflected in the title chosen for the Centre. The rather large number of senior scholars who had contributed to the development of the two proposals was reduced to a set of four founding directors: Metcalfe, Beynon, Coombs and Miles; who were content with this eventual definition of the scope of the centre.

The primary contract from ESRC was awarded to the University of Manchester, with a start date of October 1996. A sub contract was created between The University of Manchester and UMIST which provided for 40% of the funds to be passed directly to UMIST. This UMIST funding was used to employ 3 of the initial complement of 7.5 full time researchers who were appointed to positions in the Centre<sup>2</sup>. Administrative and support staff are employed by the University of Manchester. The two Universities contributed to the centre by releasing proportions of the time of the four directors<sup>3</sup>.

The Directors initiated a careful and time consuming process for the appointment of the research and administrative staff, and this, coupled with the need to refurbish appropriate accommodation for CRIC, meant that the Centre began operation on the 1<sup>st</sup> January 1997. It was at this point that the current office suite was occupied by the founding members of CRIC, namely:

**Directors:** Stan Metcalfe, Rod Coombs, Ian Miles, Huw Beynon.

**Researchers:** Birgitte Andersen, Mark Harvey, Richard Hull, Jeremy Howells (half time), Andrew McMeekin, Steven Quilley, Bruce Tether, Mark Tomlinson.

**Administrator:** Sharon Hammond

**Secretary:** Deborah Woodman

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<sup>2</sup> This was seen as the appropriate mechanism through which UMIST could receive proper recognition of its stake in a multi-university centre, given external contingencies such as the RAE and HEFCE funding models.

<sup>3</sup> Metcalfe and Coombs both released to CRIC for 80% time; Miles and Beynon were released for 30% and 50% their time.

The following changes in personnel have taken place since the foundation of CRIC:

- In 1999 Professor Huw Beynon left Manchester University to join Cardiff University. His chair in the Department of Sociology was advertised by Manchester University with an explicit designation of 50% located in CRIC. The chair was filled by Professor Alan Warde, formerly of Lancaster University, whose expertise is in the sociology of consumption and economic sociology. He replaced Professor Beynon as a Director of CRIC.
- Also during 1999 and 2000, as a natural consequence of career progression, two research staff left CRIC to take up Lectureships and a third to take a Senior Lectureship in other Universities<sup>4</sup>. Subsequent to this, Dr. Sally Randles, Dr. Jason Rutter and Dr. Dale Southerton, were recruited to the core-funded research team.
- Several additional researchers were recruited to work in CRIC on contracts supported by additional funding gained from various sources. Details appear elsewhere in this report.
- Additional part-time appointments were made to expand the support staff of CRIC.

## 1.2 The Management of CRIC

This section details the arrangements that were put in place to manage CRIC from the outset. They have served very well throughout the period.

- An Advisory Committee is chaired by Sir Robin Nicholson. It is the formal point of connection between CRIC and ESRC. It comprises academics from other Universities, individuals from industry and government, a nominee from the ESRC's Research Priorities Board, and a member of the ESRC Office<sup>5</sup>. It has met on 2 or 3 occasions each year and has been of great assistance to CRIC. It has commented substantively on research plans and research outputs, as well as giving guidance on long-term strategy.
- An Executive Committee meets monthly to manage the day-to-day affairs of CRIC. It consists of the Directors, a nominated member of the CRIC research staff, and the centre administrator.
- Although it is not a contractual requirement, the Directors deemed it prudent to establish an international scientific panel that from time to time could advise the Centre on the quality of its research programme. The panel of distinguished international scholars held its first meeting in October 1998 and the next meeting is planned for immediately after the mid-term review. The members of the panel are Prof., Richard Nelson (Columbia), Prof., Fumio Kodama (Tokyo), Prof., Jim Utterback (MIT), Prof., Bengt-Ake Lundvall (Aalborg), Prof., Robert Boyer (CEPREMAP), Prof., Michael Storper (UCLA) (See p.28 below)
- There is a monthly CRIC 'Forum' for all staff. This allows any matters relating to the life of CRIC, whether research related or purely practical, to be quickly and

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<sup>4</sup> Richard Hull to Brunel, Steven Quilley to Trinity College, Dublin and Birgitte Anderson to Birkbeck College.

<sup>5</sup> Full details of members are given in Appendix 2.

easily discussed. It is chaired by one of the research staff rather than by a CRIC Director.

- The CRIC Liaison Committee meets once per year to oversee any matters arising from the status of CRIC as a joint venture of two Universities. In addition to the CRIC Directors, the members include a Pro-Vice-Chancellor from each University, the head of the Manchester School of Management (UMIST), and the Dean of the Faculty of Economics and Social Sciences in Manchester University.
- The Directors meet annually to consider the career progression of research staff. Since the inception of CRIC several staff have been promoted from Scale I to Scale II posts, and there has been one promotion to a Scale III post. These promotions have to be proposed to and approved by the relevant committees in the two universities.
- The Directors have also established an annual parallel process to guide them in matters of staff appraisal.

Professor Metcalfe served as Executive Director of CRIC for the first 2 years, until January 1999, when Professor Coombs took over for the next two-year period<sup>6</sup>. Leadership style has been 'collegial' throughout. Professor Coombs will remain as Executive Director until the Mid term Review is complete in March 2001. The position of Executive Director beyond this date is currently under discussion in the two Universities.

### **1.3 Aims and Objectives of CRIC**

#### **1.3.1 Intellectual Objectives**

To assist the reader we reproduce here a statement of the aims and objectives of the Centre as first formulated in the award.

*“Major advances are expected in these areas:*

- *the study of innovation as a social, economic and managerial process;*
- *the contribution of innovation to the national competitiveness of firms and sectors;*
- *the comparative understanding of national innovation systems and their relationship to processes of globalisation.*

*It is also expected that in making these advances, the Research Centre will make significant contributions to the following areas:*

- 1. the organisation of economic enterprises;*
- 2. the institutional context of innovative activity; understood through a comparative framework analysis.*
- 3. workplace behaviour, its relation to patterns of organisation and the process of innovation and to the following subject areas*
  - ◆ *economics*
  - ◆ *management science*
  - ◆ *economic sociology*
  - ◆ *science and technology policy”*

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<sup>6</sup> This arrangement was specified in the ESRC award.

The above statement of intellectual objectives is rather abbreviated (being drawn from a contract document) and does not fully capture the issues which animated the team at the birth of CRIC and which have been the driving forces behind the research programme. It is useful at this stage then to elaborate on this somewhat. We can do this by stating what the Directors in particular perceived to be the *problems* in the received literature on innovation and competition, which they hoped to tackle in the research. These were:

- Our understanding of innovation is still dominated by the context of manufacturing, yet services are a dominant part of the economy, and service innovation is pervasive throughout the economy. Thus an important question is how to revitalise our conceptual frameworks to redress this imbalance?
- The double- sided relation between innovation and the competitive process in the context of increasing globalisation and the strengthening of the single market in Europe, provides an opportunity to rethink and advance our understanding of the dynamics of modern capitalism.
- The literature on ‘systems of innovation’ (both national and sectoral) makes an important contribution to seeing innovation as shaped by forces beyond the firm. But it begs many questions in terms of its relationship to the dynamics of systems; the competitiveness of systems, and the linkages to theoretical perspectives such as evolutionary economics and economic sociology.
- The treatment of demand in innovation studies is very much less developed than the treatment of supply. The tacit model of demand in operation is derived from a simplistic notion of markets. This does not deal well with situations of novel products and services for which no prior market exists. Nor does it incorporate insights from other social sciences concerning the alternative explanations of consumption behaviour.

These concerns were important starting points for CRIC. It became clear quite quickly that solving them would require a significant shift in the paradigm of research on innovation, rather than simply an extension of existing paradigms. Together with the various backgrounds of the Directors, they resulted in the early formation of the view that a multi-disciplinary and comparative perspective was vital, whatever difficulties that might create in terms of managing day-to-day work, and in terms of publishing strategies in a world dominated by discipline-based journals. Consequently the backgrounds of the initial team of researchers spanned the disciplines of economics, sociology, geography and management; and included researchers with a mixture of expertise in quantitative and qualitative research methods.

### **1.3.2 Organisational Objectives**

The formation of CRIC was seen by its directors as an opportunity to stimulate research on innovation and competition more widely in their various ‘home’ departments. It was also seen as an opportunity to pull together and better co-ordinate what was an already substantial body of work in this field being done by sizeable groups in each of these home departments (especially in PREST and in MSM). Initially however, the formation of CRIC created another centre of innovation

research in Manchester. This initial separation of CRIC from the other centres of innovation research in Manchester reflected the need to give some autonomy and development space for the distinctive CRIC research agenda, and the new group of staff recruited to pursue that agenda. The organisational context for innovation research in Manchester which has now resulted is therefore complex and needs to be briefly outlined.

The staff of CRIC (initially 13 people, now 18) occupy self contained office space which is not physically connected to any of the other departments or schools within the two Universities. The directors of CRIC have offices in CRIC **and** in their ‘home’ departments. This has create a good environment for CRIC staff to develop a strong team spirit with good collegial and flexible modes of working together. It has also presented CRIC with the challenge of drawing from and contributing to the great pool of expertise in the staff of the ‘parent’ institutions from which it was spawned. These include in particular the members of the Federal School of Business and Management:

- Manchester School of Management, UMIST (especially CROMTEC: The Centre for Research on Organisations, Management and Technical Change)
- Manchester Business School
- PREST (Programme of Policy Research in Engineering Science and Technology)<sup>7</sup>
- Manchester School of Accounting and Finance

They also include the other departments of the Faculty of Economics and Social Studies in Manchester University.

The main mechanism for creating links with these other bodies has been to invite interested academic staff to become ‘CRIC Associates’. This involves them playing a role in the research of CRIC either by contributing directly to projects, by publishing in our discussion paper series, and attending our seminars and workshops<sup>8</sup>. Several CRIC Associates have played leading roles in some CRIC projects, and they are mentioned at the appropriate points in the accounts of projects given in section 2 of this report. Subsequently, some new projects have been funded which have resulted in some staff having joint appointments in CRIC and PREST. Recently, in the context of the special project for the Director-General of the Research Councils, a team was assembled which included members of CRIC, CROMTEC and PREST.

There is no doubt that CRIC has benefited enormously from its location on a single site and that, with the strong support of the two Universities, it has been given the freedom to act as an autonomous unit. Although it is fashionable to argue the case for virtual forms of research organisation, we believe that in our case the physical form of this Centre, free from Departmental boundaries, has proved more than adequate to the task. We accept, of course, that more can be done to exploit the synergies between CRIC and the wider social science milieu in Manchester. Now that the distinctive identity of CRIC’s intellectual programme has been firmly established, in the next

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<sup>7</sup> CROMTEC and PREST are CRIC’s partners in the research programme to be conducted in new premises as a result of the Federal School’s successful JIF bid. This issue is discussed in detail in section 1.7.2. Brief descriptions of PREST and CROMTEC are available in Appendix 5, together with details of the JIF research topics

<sup>8</sup> A list of CRIC Associates can be found in Appendix 3. It also includes individuals from outside Manchester who collaborate with CRIC.

stage of CRIC's life, we will pursue the integration of CRIC and the other major elements of the innovation research community in Manchester. This will be carried forward by the plans to co-locate CRIC, PREST and CROMTEC as a result of a successful bid to the Joint Infrastructure Fund. This bid (principal applicant: Professor Stan Metcalfe) resulted in £5.7 million being awarded to the two universities to create a new research facility for the Federal School of Business and Management. The building will house three major Federal School activities, one of which will be the co-location of CRIC, PREST and CROMTEC to conduct a joint research programme. More details of this activity are given in the section of this report [1.7.2] dealing with the forward plan for CRIC.

It can therefore be seen that CRIC set itself challenging objectives. In addition to moving beyond the received paradigm of innovation research, it has tried to catalyse an organisational re-configuration of the academic community relating to innovation research across four departments in two universities. The process is not complete, but it has moved forward considerably in 4 years.

## **1.4 Progress Towards CRIC's Objectives**

### **1.4.1 The Core-funded Scientific Programme**

Substantial progress has been made in all three of the primary domains targeted by the centre. These targets are set out in 1.2.1 above and can be expressed in shorthand as:

- i) Improved understanding of the nature of the innovation process
- ii) Improved understanding of innovation and competitiveness
- iii) Improved understanding of 'Innovation Systems'

We begin with a summary of the main conceptual and empirical achievements of CRIC's work to date. This is evolving into a synthesis and articulation of ideas spanning evolutionary economics, instituted economic processes and the social dynamics of consumption. These ideas have developed within the context and stimulus of an empirical programme that is focused around the study of service innovation.

### **Summary of Conceptual and Empirical Findings**

A much more comprehensive account of CRIC's research to date is given in Part 2 of the report. It is there that we present our work in a form which is suitable for an academic reviewer to form a proper appreciation of CRIC's work. This section presents a synopsis of the key intellectual gains made in the programme thus far. This should help the reader understand how our view of the future of the programme contained in section 1.7 has emerged. This section also presents a selection of some of the more focused findings of particular pieces of work, and refers forward to the relevant sections in Part 2 where they are presented in more detail.

#### *Conceptual Findings*

We started with the aim of advancing the study of innovation and its relation to competition by drawing together contributions from the disciplines of economics,

sociology and management. We believe that we have made significant progress in developing a new economic-sociological approach to these issues but that much remains to be done. At the broadest level we have begun to combine insights from evolutionary approaches to economic change with the complementary idea of ‘instituted economic processes’. This latter concept, which derives from the work of Polanyi, refers to the notion that economic processes such as production, exchange and innovation present themselves in a variety of unique and specific forms because of their dependence on the intertwined legal, cultural and regulatory structures which prevail in a given location and time. (See section 2.3.14 for a fuller discussion). This has resulted in new understandings of the systems approach to innovation. In particular, our focus is now on the dynamic processes through which innovation systems are generated and reconfigured over time at many different levels. This is a gain over existing work which has taken a more static view of innovation systems.

### *Distributed Innovation Processes*

An aspect of the innovation process we have focused on is its increasingly ‘distributed’ character. A substantial literature already existed on the increasing tendency for innovations to be the result of co-ordinated action by several firms and other agencies working in complex networks and relationships. CRIC has added significantly to the empirical data on this phenomenon through its analysis of survey data. Additionally, CRIC has made a number of theoretical advances in the understanding of ‘distributed innovation processes’.

*Firstly*, work on knowledge-intensive business services (KIBS) [2.3.6]<sup>9</sup>, on outsourcing [2.3.5], and on cross sectoral knowledge flows [2.3.9], has combined to show that the patterns exhibited by distributed innovation processes (DIPS) increasingly tie together firms that produce *services* with firms that produce *physical artefacts*, and service innovations with physical innovations. This work sits on the platform of a very substantial critique of received thinking about innovation in services and a strong articulation of the case for a move away from models of innovation still rooted in a narrowly-understood ‘manufacturing’ setting.

*Secondly*, work on the organisation of innovation in the food sector [2.3.13] has shown that in some cases, large service-providing businesses which are close to consumers (in this case supermarkets) have succeeded in re-organising (or ‘re-instituting’) innovation processes. This re-organisation has shifted the locus of co-ordination of innovation down the supply chain to the retailer, with significant consequences for who participates in the network, the share of value-added amongst participants, the process of innovation amongst ‘manufacturers’, and the organisation of demand for the products. This work has also shown how this changing pattern has proceeded differently in different parts of Europe with direct consequences for competitive positions of the DIPS in different countries.

*Thirdly*, theoretical work using a capability theory of the firm, and, separately, using the Polanyian idea of ‘instituted economic process’, has addressed the *dynamics* of DIPS. This reflects a gap in the received literature, which is strong on the importance of DIPS as a means of organising the inputs to the innovation process, but which does

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<sup>9</sup> Numbers in square brackets refer to sections in Part 2.

not theorise how DIPS emerge, evolve, and decline. This work has also drawn from our critique of the ‘systems of innovation’ literature, which was conducted through empirical work in the chemical sector, and in airports and air travel.

Taken together then, these three areas of advance have developed a perspective on innovation systems and on DIPS which gives a new prominence to *service innovation*; which demonstrates some conditions in which *service organisations* can be the principal ‘orchestrators’ of DIPS and which analyses the ‘*comparative dynamics*’ of competing DIPS in different countries. **The key point about this work is that it is directed at the changing nature of distributedness.**

### *Competing Forms of Competition*

The discussion of CRIC’s advances in the analysis of DIPS given above has already made reference to the relationships between DIPS and *competition*, which therefore addresses one of the key topics in the prioritised areas of CRIC’s programme. Some further elaboration is appropriate here.

Simply put, the argument is that ‘pure’ markets are the exception rather than the rule, and that all ‘markets’ are in fact complex regulated sets of institutions which create a wide variety of distinctive and highly ‘normed’<sup>10</sup> patterns of competition. Through CRIC’s work on innovation in food [2.3.14] we have developed this line of argument. In particular we have analysed the processes through which particular instituted forms of competition are *created*. This has drawn attention to the power relationships between companies in different parts of a production or supply chain, and their relative abilities to influence the norms involved in defining a particular competitive regime. In a second elaboration of the argument, this work has explored what happens when two ‘differently normed’ competitive regimes (for example the Northern and Southern European regimes for tomato production, distribution and retailing) start to ‘compete’ *with each other*. As has already been pointed out, this analysis meshes with our analysis of changes in the patterns of the distributed innovation systems involved. In the traditional treatment of competition as a state of affairs, the test for competition is usually taken to be market structure or realised profit margins. The number of firms and customers and the possibilities for strategic interdependence of action become the focus of attention. In our research programme we take a quite different view of competition as a process of change in which innovative behaviour is a crucial source of competitive advantage and in which institutions are crucial influences on the outcome of the competitive process. The focus is upon change, the fluidity of market shares, the improvement in product and process performance over time, the development of competitive strategies, and the kinds of knowledge involved in competing. Competition is not to be judged at a point in time but over time as a process, and the measures of competition are measures of the changing relative position of different activities. Here we are drawing upon and integrating at least three distinctly different traditions. The first is the Hayekian, Austrian tradition on the nature of competition as a continual discovery process when information and knowledge is unevenly distributed across agents in the market economy. The second

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<sup>10</sup> We are referring here both to the formal norms which are implemented through standards, regulations and competition policy; and to the informal norms through which firms and other economic agents negotiate what is appropriate and expected behaviour in a particular ‘market’ situation.

is the Nelson /Winter evolutionary tradition in which competition is a dynamic process which is both driven by innovative behaviour and in turn continually shapes the innovation process. The third is the modern industrial organization tradition, of which Porter is a principal exponent, which emphasizes the dynamic conditions for innovation creation and application in specific market contexts.

**It is a consequence of this line of reasoning that CRIC is in fact going beyond current debates about the relative explanatory merits of *national* innovation systems versus *sectoral* innovation systems.** By jointly analysing the specific form of a distributed innovation system *and* its distinctively normed competitive regime, CRIC has shown that innovation systems can generate competitive advantage at a variety of different *scales*. The national scale is a specific case rather than the general case. It follows from this that our work on DIPs and on the competitive process are mutually supporting. DIPs provide the ‘local’ frameworks within which firms innovate in the search for competitive advantage, and the development of any DIP is shaped by the competing activities of firms seeking to articulate an innovation network to their particular competitive advantage. We have argued that these distinctions are of considerable significance to the formulation of national science, technology and innovation policies. **Neither the working of innovation systems nor markets is to be taken for granted, both are instituted and, we argue, mutually so.**

Taking these ideas together is leading us to new ways of understanding growth in knowledge-based economies, and the links between growth, competition and innovation. This approach emphasises the role of enterprise and its instituted nature and connects the dynamics of growth with the ongoing generation of micro variety of economic behaviour. As we understand it enterprise economies are kept far from equilibrium by innovation within a competitive process. **Capitalism in equilibrium is a contradiction in terms.** [2.3.3]

#### *Consumption in the Analysis of Innovation*

Much of the received literature in innovation and competition can be criticised as being biased towards supply-side analysis. This is a strength and a weakness of the broadly neo-Schumpeterian tradition. It is a strength because it challenges the weakness of neo-classical economics in analysing the role of new knowledge, technology and entrepreneurship in disrupting market equilibria. It is a weakness because it still regards the characteristics of demand as essentially given and unproblematic. Despite the textbook wisdom that successful innovation is ‘market-driven’, there is still a gap between this literature and, for example, the literature on marketing practice which incorporates complex concepts and processes for the ‘shaping’ of customer attitudes, preferences and behaviours. Even the recent advances in evolutionary economics as applied to innovation have not really changed this position.

This state of affairs was part of the problem set which motivated CRIC from its outset, and was reflected in particular in one of our seven initial projects which was labelled ‘Analysing Trajectories of Demand’. This part of CRIC’s work programme has also been successful and has grown in its relative importance over the life of the

centre.<sup>11</sup> **The essence of CRIC's advance in this field is break from a perspective on innovation that borrows an essentially un-modified concept of 'market-demand' directly from the discourse(s) of economics.** Instead we have begun with a focus on the consumption practices of final consumers as they are embedded in their broader social and economic circumstances. This is not to say that there is still not a task to do to describe market institutions in any given case, but it does mean that we cannot 'read-off' consumption practices from those institutions. [2.3.11]

Application of a distinctive range of statistical techniques which are considerably more sophisticated than most British studies in the field of consumption has allowed significant contribution to debates about the importance of lifestyle in contemporary societies. Many commentators have suggested that class and other socio-demographic categories have become less important in determining consumption behaviour and that volatile lifestyle affinities have created a more complex pattern of consumer behaviour. CRIC's quantitative modelling work using family expenditure survey data on consumer durables and food products showed that even after controlling for income differences a simple and traditional measure of social class continued to explain substantial variations in diffusion rates for such goods. **Such work suggests the importance of continuing to analyse consumption behaviour in the context of social structures and social trends.**[2.3.10]

#### *A New Framework*

The three prongs of CRIC's advances: in 'distributed innovation'; in 'competing forms of competition'; and in 'consumption practices in innovation theory'; have interacted with each other more and more strongly as the programme has developed. In fact, it is true to say that they have been jointly developed out of a shared body of empirical and theoretical work. This relationship is a substantive as well as a procedural one, in that our concepts in these three domains now increasingly interlock and depend on each other. **In section 2.5 we provide a discussion of these three themes and their interactions, which is presented both as an intellectual *output* of the first 3 to 4 years of CRIC's work, and as an organising framework for future research.**

It is dangerous to make premature claims for a 'new paradigm'. The three elements of our analytical framework discussed above are not perhaps on their own strong enough to bear that weight. **However, they are augmented by a fourth feature of CRIC's work, which is its insistence on a fundamental re-thinking of innovation concepts in the light of the growth of service organisations in the economy, and service innovations in all organisations.** This involves a re-thinking of the relative roles of 'hardware-embodied' knowledge (technology traditionally defined as artefacts) and non-hardware-embodied knowledge in innovation. We believe that this is not just an 'adjustment' of received paradigms of innovation research, but a more substantial shift. Maintaining a focus on this service innovation agenda, combined with the three-fold theoretical approach discussed above, leads us to contend that we are in fact in

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<sup>11</sup> Of course, the replacement of one of the Directors with a new Director with a special expertise in the sociology of consumption has been a very welcome strengthening of CRIC's ability to attack this problem.

the process of developing a new paradigm. For the time being we are using the working title of the ‘Service-Intensive Innovation Paradigm’.<sup>12</sup>

### *Empirical Results*

Here we summarise some of the striking results arising from our work (numbers in brackets, at the end of each result, refer to the section in Part 2 which provides a more detailed account of the topic).

*In various pieces of work relating to innovation systems, we identified the following interesting results:*

- Heathrow Airport achieves a 20% increase in the efficiency of runway utilisation through a series of service-based, procedural innovations over a period of 17 years. In each of these years planners considered that the airport was operating at saturation levels. This mode of innovation is an emergent property of the specific *innovation system* created by the actors involved in air transport. [2.3.1]
- New ways of analysing patent data identify two well-defined technological epochs in the development of the international chemical industry since 1920. In each of these epochs, distinct *systems of interlocking technologies* provide the platform for the industry.[2.3.2]
- New methods for the measurement of structural change derived from evolutionary principles track the evolution of the American economy over the period since 1964. Despite the productivity slowdown they indicate a rapid rate of structural change with a major structural break around 1980. These techniques may therefore provide a new method of revealing changes in innovations systems [2.3.3]
- The limitations of the market-failure foundations of innovation policy are identified in CRIC’s approach to distributed innovation processes and a new policy rationale developed around the idea of system-failure. [2.3.3]

*CRIC’s work on patterns of innovation across firms of different types and in different sectors revealed a number of interesting results related to the distributedness of innovation:*

- Contrary to the received wisdom that small firms are more efficient innovators than large firms, CRIC has shown that the economic value of innovations increases with firm size. The number of innovations from small firms, therefore, over-represents their contribution to innovation. [2.3.5]

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<sup>12</sup> It should be clear that this does not imply **any** reduction in the importance of public and private investment in R&D in the physical and biological sciences, or in the dynamic role that the technologies produced by this R&D play in economic change. Indeed much of our work continues to follow the ‘traditional’ concerns of innovation scholars through measuring, tracking, and forecasting these technologies and their ramifications. However, we believe that the economic mobilisation of these technologies depends more now on service innovation than hitherto, and that the two domains of study urgently need integration.

- The importance of NTBFs is not found largely in terms of employment creation but rather in terms of the complementary role they play to large firms in the ecology of innovation networks. These two results shift the agenda for analysis of innovation and small firms to one of their role in distributed systems.[2.3.5]
- Analysis of the CBI Innovation Trends data demonstrates that knowledge intensive service sectors exhibit more radical innovation styles than manufacturing sectors. [2.3.8]
- Foreign firms operating in the UK are found to be more innovative than domestic firms and more likely to have collaborative arrangements in support of innovation. [2.3.8]
- A study of detailed input output data shows that at sectoral level, the use of knowledge intensive business services is positively correlated with the growth and level of labour productivity in the UK and Japan, but with significant differences across countries and time. [2.3.9] Coupled with the previous result, this result demonstrates the importance of seeing innovation processes as distributed across traditional sectoral boundaries.
- Contrary to prevailing wisdom, developing economies are found to exhibit the productivity enhancing effects of knowledge intensive business services. [2.3.9]
- Analysis of the Community Innovation Survey showed that service innovation rests on different knowledge inputs than those for manufacturing; they are less R&D intensive and they rely more on human capital. [2.3.8]
- CRIC research supports previous studies in identifying increased activity in R&D outsourcing. But, more importantly, it identifies a qualitative change, revealing contract R&D firms to be more proactive and often dominant partners in innovation processes. This is in sharp contrast to the traditional view that these firms are reactive to manufacturing firms' decisions to outsource. [2.3.4]

*Various projects have yielded new insights into changes to the organisation of retailing and in patterns of consumption:*

- Contrary to claims that social class is no longer a significant factor in consumption behaviour, CRIC finds that class factors are highly significant in the evolution of UK demand for consumer durables and food *after* controlling for the effects of income differences. [2.3.10]
- One of the distinctive characteristics of UK supermarkets is that they have created key conditions for new styles of competition and innovation. Own label food manufacturers typically produce 1000 new products per year, some radical, others novel, in contrast to branded manufacturers who typically produced 4 to 5. [2.3.13]
- The first GM product to be commercially produced with a view to increasing food quality and manufacturing process as against agricultural performance was

produced in the UK in a way that involved supermarkets, biotechnology companies, and food processors in a distinctively new collaborative process. [2.3.13]

- New centralised and computerised systems of food distribution enable producers within supermarket supply chains to gain access and respond to near real time sales data from Electronic Point of Sale check-out information. This changes institutional relationships between supply and demand as well as asymmetries of information between consumers, manufacturers, and retailers. It is producing both a new distributed innovation system and a new competitive regime. [2.3.13]

*Aspects of our work that has been future orientated has used new techniques for evaluating the uptake of major new technologies:*

- Economic modelling based on ‘desirable but credible’ scenarios for biotechnology and ICTs in the UK in 2005 forecast 0.2% and 1% contributions, respectively, to the percentage GDP growth rate. ICTs are forecast to bring about a reduction in price inflation of nearly 1%. [2.4.4]
- The development of electronic commerce in Europe will not follow a "catch-up" path set by the USA based largely around the web and personal computers. Instead it will make extensive use of interactive digital television and mobile phones which already have a high level of dissemination across many European countries. [2.4.1.4]

These rather naked examples of ‘findings’ presented above are obviously oversimplified, but they serve to give an illustration of how our conceptual agenda has been pursued through research on quite concrete innovation topics.

#### **1.4.2 Contributions from Non-Core Funding**

The advances achieved towards the centre’s intellectual targets described above have been achieved principally by application of the core funding. This takes the form of meeting the salary costs of the core research team (other than the Directors, whose costs are met by the Universities). However, significant additional funding has been won by the centre (approximately £700,000 at the time of writing) for additional projects. These additional projects have contributed *both* to the main intellectual agenda and to the formation of new lines of research. Drawing a clear ‘accountability’ line between outputs from the core funding and those from the additional funding is therefore not straightforward. The individual projects supported from the additional funds are detailed in Part 2 of this report [section 2.4]. In order to give a framework for understanding this issue we can group externally-funded work and its relationship to CRIC’s core-funded work into four main categories as follows.

- *‘Integrated Projects with no additional staff’*. This is work which CRIC wants to do anyway, as part of its core agenda, but where external funding from another source creates an opportunity to do that work in a way which would not otherwise be possible. An example of this is that the CBI funded CRIC to analyse its Annual Innovation Survey data. Because one of our core projects was precisely concerned

with Measurement of Innovation, it was positively advantageous to have access to the CBI data. The funds therefore augment the core funding.

- *'Integrated Projects with additional staff employed'* These are projects which again cover issues which sit squarely in the CRIC core research programme. Being more sizeable projects, they involved teams comprising CRIC core-funded staff *and* additional staff hired on project-specific contracts. Examples are the EU and DTI funded projects to analyse the data from the Community Innovation Survey. These projects delivered specific outputs for the funders, but also gave privileged access to survey data not available to other researchers, which enabled work to be done for the core programme which would otherwise not have been possible. The funds therefore augment core funding.
- *'Diversification projects'* These are projects which open up new topics which relate to CRIC's broader programme but were not explicitly foreseen or mentioned at the founding of CRIC. An example is the ESRC funded project on 'Innovations in Corporate Risk Management'. This project employed an extra researcher, and did not involve inputs from core funded CRIC staff. The intellectual integration of the project into CRIC is the responsibility of the PI, who for most of these projects is one of the Directors.
- *'Special projects'* There is only one major example here. From autumn 1999 until spring 2000 the Centre devoted significant core-funded resource to a project funded by ESRC, but requested by the Director General of the Research Councils, Dr John Taylor. This was called *Success in ICT and Biotechnology in 2005* and was concerned with identifying plausible scenarios for the economic uptake and consequences of these technologies in the UK in 2005. Two CRIC core funded researchers worked on this full time, and three of the Directors devoted large parts of their time to it. Additional staff were also hired, and CRIC associates in Manchester and elsewhere made major contributions. In the *short-term* the project did cause delays to some aspects of the core programme because of the diversion of resources. However, the project was a very positive venture for the centre to engage in; was well received by senior industry and policy users; reflected well on the ESRC; and was perfectly consistent with CRIC's broader mission as a centre of excellence in analysing innovation processes. Also, its *longer term effects* on the core programme are positive, because the expertise and contacts acquired in Biotechnology and ICT fields are now being used, following the advice of our Advisory Committee, to develop new research plans in these empirical domains, but set *within* CRIC's overall intellectual framework as described earlier in this section.

CRIC is confident that its external funding over the first four years has played a very positive role in complementing the core funding. It has created growth and dynamism in the centre; it has enhanced the activities of the core programme; and it has played a *vital role in connecting the centre to some of its key external users in industry and government*. The scientific programme of CRIC has therefore been advanced,

deepened and widened by additional funding, and there have been relatively few opportunity costs to the core programme<sup>13</sup>.

### 1.4.3 Impact

This section gives an overview of the impact of CRIC's activities so far on the academic community and on the policy and user communities. It should be read in conjunction with section 1.5 which discusses publications. CRIC's policy has been to act as a resource for the research community, to provide a focal point for their research activity and to be a major contributor to the existing networks of international innovation researchers.

#### *Academic Impact*

We have not conducted an extensive citation-based analysis of the impact of our work on academic colleagues. This is because it is probably too early for such an exercise to have much value. Under this heading then, we can only offer some subjective impressions. The review exercise will of course have access to independent peer review to give opinions on the likely impact of our work. It is important to register here though, that the study of innovation is intrinsically cross-disciplinary, and our definition of the scope of our programme has made it even more cross-disciplinary than most other work on innovation. Conventional approaches to 'impact measurement' are difficult in these circumstances because potential academic audiences are multiple, fragmented, and often not framed within a dominant paradigm. This creates problems for publication and visibility of output, and we will return to this in the discussion of journals in section 1.5.

Nevertheless, it is our judgment that our work has had an impact on our colleagues in various academic fields, both nationally and internationally. We suggest that this can be seen in the following:

- CRIC has organised six workshops bringing together UK and overseas scholars and has appointed a number of UK researchers as CRIC associates. In addition, it has continued to collaborate and interact with other established research institutes including SPRU<sup>14</sup> (Sussex) and the CBR (Cambridge).
- CRIC is seen in Europe, and increasingly in North America, as a leading source of important new ideas and data about *services innovation* in the broadest sense. The evidence for this comes in the form of citations, invitations to present at meetings and invitations to engage in joint tenders for projects.
- A number of leading international research centres and organisations have taken the initiative in establishing formal relations with CRIC and to include CRIC in their research networks. These include the Sloan School at MIT, the Max Planck Institute of Evolutionary economics in Jena, the Chinese Academy of Social Sciences in Beijing, and the University of Rio de Janeiro, the Innovation

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<sup>13</sup> However, it is our judgment that, at least during this early period, any *greater* involvement in addition fund-raising could have taken us into the range where opportunity costs and management time would have had a potentially negative effect.

<sup>14</sup> JSM participated in the recent SPRU internal academic review and is a member of the CBR advisory committee.

Laboratory at the University of Turin, CESPRI at Bocconi University, the Department of Economics at the University of Queensland, the Sir Arthur Lewis Institute of Social and Economic Research (Jamaica and Barbados).

- The view that innovation researchers need to re-calibrate their sights to take account of a service-intensive world has gained ground strongly since CRIC's creation. Of course CRIC does not claim sole credit for this. Many other researchers are contributing to this trend. But we do contend that we are leading opinion-formers in this community.
- Academics who are familiar with our work are struck by the gains we have made from our decision to explicitly look for cross-disciplinary interactions between the perspectives coming from economic sociology and the more 'mainstream' approaches to innovation studies which are derived from various schools of economic and management thought.
- CRIC's web-site has been a very important route for disseminating CRIC research. To date, over 4000 downloads have occurred of CRIC's papers.

### *Policy Impact*

Judging the policy impact of a centre's work after only 4 years of work presents its own difficulties. It is our judgment that several of the underpinning approaches to innovation policy issues which were present in our original applications, and which have since informed our work, have now become more accepted in policy discussions. Of course, just as in the academic arena, there are multiple influences at work here, and CRIC would not wish to claim sole responsibility for these shifts. But there are some aspects of current policy debates where we believe our work has been viewed as genuinely useful. We will summarise these in broad terms here, more detailed information on the policy implications of particular pieces of work can be found in other sections.

- CRIC's sustained and wide-ranging work on all aspects of services innovation appears to have contributed to policy change concerning the *survey and measurement techniques* being developed by various statistical agencies. Both our conceptual work and our detailed analysis of existing innovation statistics has led to the establishment of detailed professional dialogues with Eurostat, OECD, DTI and CBI on how to tackle the problem of collecting better data on service innovations across all sectors, and on innovations in 'service sectors'. There is no doubt that policy on measuring service innovation has shifted dramatically in recent years.
- OECD has also engaged with and been influenced by our work on the role of evolutionary economics as an underpinning framework for innovation policy.
- Intellectual property issues relating to service innovation is another issue which has risen in visibility on the policy agenda over recent years. CRIC is active in discussions with UNCTAD on this topic.
- The 1998 Competitiveness White Paper was a very significant development in UK policy because of its emphasis on the 'knowledge-driven economy'. It's approach puts 'manufacturing' and 'service' activity in better balance in terms of their role in the economy than hitherto, and the understanding of the distributed nature of innovation goes beyond a mechanical exhortation to firms to engage in more collaboration. Given CRIC's concerns with services, with distributed innovation and with knowledge-intensive business services, we

found the White Paper and the associated policy debates and shifts to be very positive in terms of strengthening the quality of our dialogue with DTI.

- CRIC work on innovation and small firms is now used in the CEC as part of the received wisdom on this issue, and was also influential in the considerations of the House of Lords Select Committee on European Affairs.
- Work at CRIC on innovation in food products resulted in CRIC staff being asked to submit evidence to the Competition Commission Enquiry into Supermarkets.
- The Project on ICT and Biotechnology for the DGRC fed directly into a number of policy discussions related to the 2000 Spending Review, and is now having wider impacts in the policy-making communities related to those two technology areas
- This ‘convergence’ of academic and policy agendas has also been visible in the discussions leading to the 2000 White Paper on Science and Innovation led by OST. These discussions have also been notable for the engagement of the Treasury and the DfEE. Two CRIC Directors were invited to participate formally in these discussions. Their contributions were well-received and provided an opportunity for CRIC’s research findings to inform policy discussion very directly. The context bears re-iteration: *the degree of shared frameworks between academics and policy makers on matters relating to innovation is probably greater now than at any previous time*. This makes the possibilities very favourable for ‘impact’ of the centre generally, and of particular pieces of work.

### *User Impact*

CRIC’s approach to this issue is not simply to ‘disseminate output’, important though that task is. Dissemination alone results in a one-way relationship which does not involve the degree of on-going relationship with research users which is especially appropriate to a topic such as innovation. Our approach therefore is a more interactive one which has a number of dimensions. The principal ones are:

- **User-initiated research.** CRIC has been active in building relationships with relevant agencies in the user communities which enable us to carry out *commissioned pieces of research or consultancy* for them. These ‘integrated projects’ (see section 1.4.2 above) combine a focus on meeting directly the research and policy needs of the users with an enrichment of CRIC’s own core academic agenda. Examples of this are our commissioned work for the DTI, for Scottish Enterprise, for UNCTAD, for the OECD, for the EU, for the Design Council, for the OST, for the CBI and so on. All of this work is characterised by an ‘end-to-end’ collaboration in the projects, in which the users and beneficiaries interact with CRIC in the formation of the research questions, in the securing of the data, and in the policy interpretation. The result is a benefit for the users *and* an enrichment of the core research programme<sup>15</sup>.

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<sup>15</sup> The DGRC project ‘Success in 2005 in ICT and Biotechnology’ (see section 1.4.2) was a particularly large and complex example of this relationship. Whilst its initial impact on the core programme was to slow some things down, its long term impact is more consistent with the broad sweep of this category of user-driven work, in that it has had very positive impacts on the evolution of CRIC’s long term research possibilities in the Biotechnology and E-Commerce fields.

- **CRIC Events for Users.** Relationships with users depend on dialogue to augment the role of formal public documentation. CRIC frequently finds it valuable to organise specific events for targeted groups of research users. These facilitate dialogue and enable researchers to gain a deeper understanding of users' perspectives. Examples of these events include:
  - A meeting on E-Commerce jointly organised by CRIC and the Consumers Association
  - A meeting with staff from the North West Regional Development Agency to explore shared interests.
  - CRIC provided the intellectual and organisational support to enable the DTI to be the UK Host for the 'Six Countries Programme' Conference in the UK in 1999. (This is a network of innovation policy staff from the government agencies of various nations).
  
- **Participation in Events for Users organised by other Agencies.** A major example of this type of activity is presentations at events set up by ESRC, for example:
  - Presentation at ESRC's seminar at national SET week (March 99)
  - Providing presentations for the ESRC's annual seminar series at DTI
  - Panellist at the ESRC/DTI/CBI conference on 'Experiencing Innovation' (Spring 2000)
 In addition, CRIC staff participate in policy-oriented events organised by other agencies such as the OECD, EU, CBI.
  
- **Personal Relationships of CRIC staff with Users.** It is a feature of CRIC being involved in the activities listed above that CRIC staff become involved personally in more one-to-one relationships with policy agencies and commercial firms. CRIC Directors' involvement in discussions on a White Paper have already been mentioned. In addition it is worth noting that many CRIC staff have formal and informal consulting relationships with several other public and private sector organisations. Several of these are at Chief Executive and Board level. (Details available in part 3)
  
- **The CRIC Web Site.** Finally, CRIC has given particular attention to the role of its web site in user relationships. The extensive downloading of our discussion papers from the web site has already been referred to. The site has also been used to provide dedicated support to various events. Special passworded sections of the web site were used to directly organise the registration and documentation for some quite complex events, including for example the DGRC project workshops and the 8<sup>th</sup> International Schumpeter Society Conference. This has been resource intensive, but has been well-received by our users. We believe that CRIC and other ESRC centres will need to plan for more of this web-enabled user engagement in future.

The range of activities described in this section is, in our contention, a natural corollary of the claims made above for the 'impact' – both policy and academic – of CRIC research and CRIC researchers.

## 1.5 PUBLICATION AND DISSEMINATION

### 1.5.1 Publication activities

Full details of all of these published outputs are available in section 3 of this report but the headline figures are reproduced here for convenience. Totals published and forthcoming in the various categories since the inception of CRIC are as follows:

	<b>PUBLISHED</b>	<b>FORTHCOMING</b>	<b>TOTAL</b>
<b>BOOKS</b>	<b>14</b>	<b>9</b>	<b>23</b>
<b>BOOK CHAPTERS</b>	<b>66</b>	<b>33</b>	<b>99</b>
<b>REFEREED JOURNAL PAPERS</b>	<b>68</b>	<b>12</b>	<b>80</b>
<b>OTHER PUBLICATIONS</b>	<b>9 WORKING PAPERS 38 DISCUSSION PAPERS 4 BRIEFING PAPERS</b>	<b>1 BRIEFING PAPER</b>	<b>52</b>
<b>CONFERENCE PAPERS</b>	<b>202</b>		<b>202</b>

Some comment on CRIC's publication strategy may be helpful to the interpretation of these figures.

The scholarly audience for research on innovation is neither simple nor clearly bounded. When the agenda is subtly shifted to innovation *and* competition, the picture becomes more complex still. This situation requires a little description before we consider the published output of CRIC.

At the inception of CRIC the research team, being very multi-disciplinary in character, had varying degrees of familiarity with the 'what and the where' of publishing strategies for research on innovation. As an exercise in knowledge sharing, and as an aid to less experienced research staff, CRIC produced a list of Journals which publish material on innovation, broken down into different subject categories which approach innovation in different ways, and have different reasons for their engagement with innovation<sup>16</sup>. The main categories of journals are as follows:

- *'Mainstream Innovation Studies' Journals*. These journals are for the specialist academic community who study innovation intensively. They carry theoretical, empirical articles, and policy articles. There is no fully developed 'dominant paradigm' but there is a very substantial amount of co-citation and shared understanding of the corpus of key works. Examples are Research Policy; R&D Management; Technology Analysis and Strategic Management.
- *'Innovation-interested' Economics Journals*. Economics is a difficult area for innovation scholars to publish in. The dominant paradigms in Economics treat innovation in a way that many innovation researchers do not find fruitful.

<sup>16</sup> The full list is on the CRIC web site. This section of the report gives illustrative examples only.

However, a small number of high quality journals which might be regarded as deviating from the dominant economics paradigm are keen to publish material on innovation provided it addresses the implications for broader economic questions. Examples are Industrial and Corporate Change; Cambridge Journal of Economics; Journal of Evolutionary Economics.

- *Science and Technology Studies journals*. This group of journals is more oriented to the sociology, history, and policy aspects of science and technology and less concerned with innovation as an economic phenomenon. It serves a smaller group of scholars than the innovation journals but there is some cross-over between the two audiences. Examples are Social Studies of Science; and Science Technology and Human Values.
- *Management Journals*. A number of management journals are well established in publishing material on innovation. Some, such as Organisation Studies, Journal of Management Studies, or Administrative Science Quarterly, tend to present the issue through the lens of the innovating *organisation*. Others, such as New Technology, Work and Employment are more concerned with the issues of work organisation and its relationship to innovation.
- *Other Discipline-based Journals*. There are numerous other social science disciplines which have at various times seen innovation and technical change as important phenomena which relate to their core agendas and have therefore devoted some effort to the topic. For example, in Sociology, the core journals have been a vehicle for a significant literature on the sociology of science and technology. In Geography, the study of industrial agglomeration has interacted powerfully with accounts of the varying and changing modes of innovation practised across space and time.
- *Other sector and problem specific journals*. Finally, there are a number of newly established journals, the presence of which indicates the growing importance of research in relation to services. These include Service Industries Journal and International Journal of E-commerce.

CRIC has regarded all of the above categories of journal as potential targets for its research output. This is reflected in the spread of publications produced in the first 4 years. We regard this as a strength of our research (and indeed of all innovation research), since we both draw from and contribute to the concerns of all these groups of scholars. Compared with other major centres of innovation research, we have a similar concentration of output in the mainstream innovation journals, but perhaps a slightly greater propensity to publish in the areas of economic sociology and evolutionary economics.<sup>17</sup>

CRIC has also regarded books as important. The field of innovation studies is one where the well-edited selection of conference or workshop papers is still seen as a very important resource by academics (and still makes a profit for publishers!). CRIC staff have been active in this area. In particular we have produced several books from the international workshops which CRIC itself has hosted (see section 1.5.2 below).

CRIC has produced its own Discussion Paper Series. These papers are refereed within the Universities in Manchester. The guideline quality level is that such papers should

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<sup>17</sup> This is a tentative and subjective impression. We have not done any systematic benchmarking against other innovation centres.

be in a state which allows them to be submitted *in parallel* to a journal. Once accepted as CRIC papers they are available as .pdf downloads from the CRIC web site. This enables the material to be communicated to international academic audiences more quickly than the time scale associated with journal publication. Eventual journal publications which follow from CRIC Discussion papers are usually revised as a consequence of the second refereeing process, and so may differ from the CRIC paper. So far we have published 38 of these papers. CRIC also produces Working papers in a similar way. These are like discussion papers but contain material such as detailed case studies or lengthy data-analysis which would be too long to send to journals, but which are worth placing in the public domain. Finally we have CRIC Briefing papers which take a single policy issue related to innovation and cover it in a style designed to feed directly into policy debates. Collectively these three types of CRIC-published outputs have resulted in over 4000 downloads from our web site, and they therefore clearly play a role in our publication strategy which would be hard to fulfil through any other means.

The last element in CRIC's publication strategy is giving conventional conference papers. This has been a prominent activity, and of course there is the usual overlap in content between conference papers and later journal papers which one finds in the normal publishing patterns of academics.

### **1.5.2 Academic Events Organised by CRIC**

CRIC has placed considerable emphasis on the organisation of academic events. These have taken a variety of forms, ranging from a conventional programme of visiting speakers at seminars through to a series of international 2-day workshops on specific themes of the CRIC research agenda. These latter events have played a prominent role in two senses. First, because they serve to disseminate CRIC's work to the attendees and raise the national and international visibility of the Centre. Secondly, because the attendees are themselves carefully chosen by CRIC to provide good papers at the workshops which stimulate our own research thinking and create collaborative opportunities. These events have been internally financed by CRIC, drawing on reserves originating in overheads on the ESRC core grant, but recently supplemented by monies arising from the additional project income of CRIC.

In recognition of the importance of these events to the CRIC programme a publishing arrangement has been negotiated with Manchester University Press for the production and dissemination of the conference volumes in hard copy and electronic formats. Brief details of the principal such events are provided here and further details are contained in Appendix 4.

#### **Workshop 1: November 6-7 1997: 'Rescheduling Time'**

This event was organised jointly by CRIC & ESRC Centre for Micro-Social Change, University of Essex. A group of 11 eminent international academic experts in the field of work and time from a range of disciplines were invited to write papers around the themes of temporality and work. The workshop was designed to develop four main themes.

- New conceptual frameworks and perspectives on temporality and work.

- Paid employment and the various forms of non-paid work [household, subsistence activity, ‘voluntary’, and reproduction of skills and knowledge].
- The societal organisation, allocation and redistribution of paid working time.
- The organisation of temporality in different employment relationships, contemporary and historical.

The insights generated in this workshop stimulated our subsequent work on consumption and time and instituted economic process [2.3.11, 2.3.14].

### **Workshop 2 : 17<sup>th</sup> / 18<sup>th</sup> March 1998: ‘Services and Innovation Systems’**

The purpose of this CRIC-organised workshop was to develop our understanding of innovation systems in relation to service activity. It is a common place to observe that almost 70% of employment in the OECD economies is linked to non manufacturing activities. It is therefore something of a paradox that the innovation systems perspective has not yet been applied to services however broadly or narrowly they are defined. Papers were presented by 13 participants from 8 countries including 2 from the USA.

### **Workshop 3: 20/21 May 1998: ‘Conceptualising and Measuring Service Innovation’**

The purpose of this workshop was to examine the problems and opportunities in measurement of services innovation. Some papers were commissioned to appraise the issue from a theoretical perspective. Other papers re-examined the experiences of existing measurement systems. Again, 13 papers were presented by participants from a wide variety of leading centres in Europe and North America.

The papers presented in workshops 2 and 3 are now published in Miles and Metcalfe (2000). The focus of these workshops has been at the core of the subsequent development of the CRIC programme.

### **Workshop 4: January 1999: Innovation by Demand: Interdisciplinary Approaches to the Study of Demand and its Role in Innovation**

This workshop was instrumental to CRIC’s work on consumption and innovation [2.3.10, 2.3.11], through bringing together scholars presenting diverse economic, sociological and managerial perspectives.

Sociologists – of technology, of networks, of consumption – have much to say about these issues; as do economists – of technological change, of the firm, of consumption. Through using different theoretical frameworks and methodological approaches, the object of their study may be the same (namely, the demand-innovative act relationship). To date there have been few attempts to find points of contact between these diverse approaches. The aim of the workshop was to bring together sociologists and economists to look at how they study the role of demand in the innovation process. Nine papers were presented and the participants came from the USA, Canada and several European countries.

### **Workshop 5: March 1999: Symposium on Approaches to ‘Varieties of Capitalism’**

This workshop involved a comparative analysis of the impact of varieties of capitalism on both innovative and competitive processes. It was organised in three sections: theoretical and analytical approaches; empirical case studies, and political dimensions. Nine papers were presented by contributors from the USA, Canada, Brazil and Europe.

### **Workshop 6: October 1999 : Joint Workshop on Innovation in Services: CRIC and Sloan School, MIT**

This workshop was proposed by CRIC, jointly organised, and held at MIT, in the Sloan School of Management. The aims of the workshop were to focus on the nature of innovation in services and how innovation in services compares to innovation in manufacturing. The workshop was based on the belief that the two are closely intertwined, but that this needs to be established conceptually and empirically. Six CRIC participants were joined by seven from MIT, and four papers were presented from each side. Discussion took place over two days and highlighted a number of common approaches to research on innovation and services. As a consequence, researchers in CRIC and the Sloan School are collaborating on two projects, one in relation to design services and the other in relation to systems of medical innovation.

### **Workshop 7: January 2000: ‘The Emergence of Markets for New Technologies of Health and Medicine’**

This workshop was organised jointly with colleague in Manchester’s Unit for the History of Science, Technology and Medicine, and enjoyed additional funding from the Wellcome Foundation. Papers were presented by 16 participants from 8 countries. This workshop stimulated CRIC’s first study of distributed innovation processes in medicine.

### **Workshop 8: May 2000: ‘Market Relations and the Competitive Process’**

This workshop focused on CRIC’s developing work on new approaches to competition and engaged a wider audience in our analysis of the interface between economic sociology and economic perspectives on this topic. This theme is beginning to engage scholars from a number of disciplines including economic-sociology and institutional and evolutionary economics. The focus was upon understanding the dynamics of market institutions and the relations between market processes and innovation. Papers were presented by 14 participants from the USA, UK and Europe. This workshop reinforced the positioning of CRIC’s work at the interface between economics and sociology.

Each of these 8 workshops has been an important element in the overall CRIC research programme. They are all generating published output. Fourteen papers from Workshops 2 and 3 have been published as a book: Metcalfe and Miles (2000), *Innovation Systems in the Service Economy*, Kluwer Academic Publishers. The materials presented at workshops 1, 4, 5, 7 and 8 are being prepared as a series of

edited books to come out in the special series agreed with Manchester University Press (see section 1.4.1 above).

### **8<sup>th</sup> Conference of the International Joseph Schumpeter Society; Manchester, June 2000.**

This biennial conference, which is organised in the country of the current president of the society, is one of the leading events world-wide for scholars of innovation and economic dynamics. Professor Stan Metcalfe, as current president, hosted the conference in Manchester in 2000. The event took place over three days with 250 attendees and 120 papers presented. CRIC staff gave four papers, in addition to Professor Metcalfe's Presidential Address. This event clearly also served to disseminate the activity of CRIC, as many of the conference delegates visited the centre and met CRIC staff.

In addition to the academic events described above, several other events were hosted in connection with specific projects funded outside the core funding. These are not reported here, though they are mentioned where appropriate in the sections of the report which describe those projects. They are consistent with CRIC's perception of its obligations as a research centre to a wider community of academics, policy makers and managers.

### **October 1998: Meeting of International Scientific Panel**

CRIC invited Professors Robert Boyer of CEPREMAP (Paris), Fumio Kodama of Tokyo University, Bengt-Ake Lundvall of Aalborg, Richard Nelson of Columbia University, Michael Storper of UCLA and Jim Utterback of the Sloan School, MIT to form an international panel to meet on an ad hoc basis to discuss the centre's research programme. The panel met with the entire staff of CRIC in October 98 for 2 days. During the meeting the panellists all presented their own perspectives and current research, listened to presentations of CRIC research, and gave very valuable comments and advice in the extensive discussions which followed. CRIC has ongoing collaborations with several of the panel members.

Other workshop-type events organised by CRIC have had a character which is at the interface of academia, business and the policy community. They are dealt with in section 1.5 which covers all aspects of relationships with 'users and beneficiaries'.

### **1.5.3 Conference Presentations, Invited Seminars.**

CRIC staff have been very active in presenting papers at international conferences in Europe, North America, Japan and Australia. They have also presented invited papers at a wide variety of workshops organised in Universities in all of these countries. Full details are available in Part 3 of this report. However, some prominent examples are reproduced here to give an indication of the types of event involved.

Metcalfe J S and Georghiou L 'Evolutionary and Equilibrium Foundations of Technology Policy' OECD Workshop: Best Practice in Technology and Innovation Policy, Vienna, May 1997

Andersen, H B, Metcalfe, J S, Tether, B. 'Systems of Innovation as Instituted Processes'. Veblen Conference on New Institutional Economics, Oslo, June 1998

Howells, J. 'Research and Technology Outsourcing and Innovation Systems', paper presented at the Innovation systems and Industrial Performance Conference, Wissenschaftszentrum Berlin für Sozialforschung gGmbH (WZB), Berlin, October 1998

Tomlinson, M. 'Knowledge & Technology Flows in the Service Sector and Manufacturing Sector: An Anglo-Japanese Comparison', STS Conference, Tokyo, March 1998

McMeekin, A , Tomlinson, M . 'Diffusion and Sociological Theories of Consumption', 'Escaping Satiation' Conference, Max-Planck Institute, Jena, Germany, December 1997

Coombs, R & Metcalfe, S. 'Distributed Capabilities and the Governance of the Firm'. DRUID Conference, Denmark, June 1998.

Miles, I, Tomlinson, M. 'Intangible Assets and Service Sectors: The Challenges of Service Industries', 'Intangible Assets and the Competitiveness of the European Economy' Symposium, Universite Catholique de Louvain, Belgium, May 1999

Metcalfe, J S. 'Institutions, Increasing Returns and Endogenous Growth', Opening address, AEPE Annual Conference, Lisbon, November 1998.

#### **1.5.4 Media Coverage**

The centre welcomes the opportunity to secure media coverage when it is possible. Several staff have received training in media relations. We do not attempt to be exhaustive in our monitoring of press coverage because of the time and resource this would involve. However, there has been a welcome degree of interest in our activities in the national and local press.

#### **1.6 Research Training and Staff Development**

##### *Research Training*

CRIC places great importance on the long term development of a vigorous PhD programme in support of the Centre's central research themes. It currently has three PhD students "on the books", but this does not give a clear picture of the true situation.

In the first instance it was clear that the primary responsibility for PhD supervision would fall upon the four CRIC Directors. However, at the time of CRIC's foundation, all of the Directors were heavily committed to PhD supervision in their home Departments. Furthermore the Directors judged at that time that the bulk of their effort should go into working with the CRIC full-time research staff to launch the core research programme. It is only now that this load is beginning to diminish sufficiently for them to incorporate PhD students in the CRIC programme.

The background context in Manchester is one in which two of the constituent partners in CRIC (PREST and Manchester School of Management) already have active MSc and PhD programmes around themes which are closely related to the CRIC agenda. It was therefore not sensible for CRIC to seek Mode A recognition from ESRC, since PREST and MSM have this already. CRIC would thereby be duplicating effort in a most unhelpful fashion. Consequently CRIC's policy is to draw on these and other training programmes within the University to support its PhD students.

Now that the CRIC programme has been clarified, we have mounted a large scale poster distribution campaign to attract PhD students, and this is supported by the CRIC website. As a result, CRIC will be admitting two new students in September 2000, bringing the total to three.

Finally, we draw attention to the fact that CRIC has consistently maintained a policy of attracting visiting students from other institutions. In this regard, we have been allocated two Marie Curie Fellowships, and we have the status of a Marie Curie Training Site, in programmes with BETA (Strasbourg) and PREST.

### *Staff Development*

We have drawn attention in section 1.2 to the formal procedures within CRIC for staff appraisal and development. We believe that one of the important outputs of the CRIC programme has been the development of a high quality group of researchers who are developing concepts and empirical tools in a genuine co-disciplinary fashion. We believe that this group of researchers is a significant national resource. We take the fact that three of our colleagues have been appointed to university lectureships as a sign of the quality of our programme. We also believe that we have the mechanisms in place to rapidly integrate new appointments into the CRIC programme.

### **1.7 Future Research Plan**

We have summarised CRIC's academic progress in section 1.4 above. There we argued that our varied programme of work, across diverse empirical settings and exploring the use of novel theoretical approaches, has moved us towards the formulation of a new 'service-intensive' paradigm for innovation research and policy. The future development of that paradigm is to be conducted through the three linked themes of *distributed innovation processes, competing concepts of competition, consumption and innovation*. This framework is both an output of the first 4 years work and an input to the future programme<sup>18</sup>. The framework itself is described in more detail in section 2.5 of part 2 of this report.

To summarise our position, CRIC has established an agenda at the cutting edge of research into the dynamics of changing distributed modes of innovation and their relation with competition and consumption. The intellectual novelty of the work comes from our focus on changes in the 'distributedness' of innovation; on the use of concepts such as instituted economic process in analysing competition; on inserting a sociological analysis of consumption practices into the demand-side of models of innovation; and on the relationship between service producing and artefact producing activities in relation to innovation. We have developed a methodological style which uses 'empirical probes' to enable us to approach our concerns from a number of directions simultaneously. Parallel to this, we are having to develop new indicators to capture the interaction between services and manufacturing.

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<sup>18</sup> This framework also maps directly on to the first 2 of the 4 themes of the JIF award research programme.

Our plans for the implementation of this research agenda in years 6 and 7 of CRIC can be divided into two parts.

- Long term programme themes
- Empirical probes

### **Long Term Programme Themes**

The following themes form the long term conceptual core of our programme. We recognise that these will continue to develop. For example, the growing politicisation of the innovation process and the increasing questioning of the value of new technologies could be developed into a more prominent part of our programme (embryonic elements of this dimension are already included in our work on instituted economic processes).

#### ***Theme 1: Distributed Innovation Processes (lead directors are Coombs, Metcalfe, Miles)***

In this long term theme we will continue to explore the consequences of conceptualising and analysing innovation as a process which is intrinsically ‘distributed’ across several co-ordinated contributing organisations, rather than contained within one organisation. Of course it is not in itself new to describe innovation in this way. In recent years many authors have provided a wealth of empirical and theoretical accounts of innovations in which the critical element in the story has been the way that several firms and other actors have all had to make necessary contributions in order for particular innovations to be realised. The starting point for much of this literature however, is to take as the ‘base model’, an innovation process which *is* contained within one firm, and then to consider how that base model needs to be modified or enlarged to encompass the complexities that arise from co-ordinating innovation activities across several firms or agencies. Our approach is to invert that assumption. We wish to add further to the insights which arise from adopting a starting point in which multi-organisation innovation is the norm, and single firm innovation is the exception.

It is possible to characterise the principal *theoretical* issues and problems which need attention if we are to improve on current perspectives and develop a more theoretically integrated model of distributed innovation.

- The first issue is the *mechanism(s) through which economic co-ordination is achieved* between the various firms and organisations who participate in distributed innovation. Whether we consider geographers describing industrial districts, or innovation scholars describing collaborative R&D activities, or any of the other literatures on the topic, we find that there is a need to somehow theorise a degree of *collective action* amongst firms in a distributed innovation network which *cannot be reduced to market transactions and formal contracts*. So to make progress we have to squarely confront this problem. Of course, the ‘National Systems’ literature already does this to some degree, but, as we have argued already it does not fully resolve the issues.

- The second issue is the need to *clearly disentangle, at least analytically, three discrete categories of activity* which are the object of economic co-ordination within distributed innovation systems. These are *first*, co-ordination amongst members of a distributed system to achieve the creation of one specific innovation; *secondly*, co-ordination which takes the form of individual members of a distributed system introducing innovations in their own direct outputs, which then require, trigger or ‘induce’ innovations in the outputs or activities of the other members of the distributed system. *Thirdly*, there is the economic co-ordination which is required to achieve regularised *production and distribution of* (as opposed to innovation in) the various goods and services produced by the member firms in the system and by the system as a whole. Part of this third domain is the specific power relationships within distributed systems which exist between firms performing quite separate economic functions; as already exemplified in our work on supermarkets and companies further up the food product supply chain.
- The third issue concerns *incentives and rewards*. The establishment and operation of distributed innovation systems has been largely analysed to date in terms of the difficulties of assembling the inputs to innovation; the attractions of reducing risk and uncertainty by creating stable networks; the economies resulting from agglomeration; the shaping forces arising from national contexts and so on. These approaches *assume* or suggest that distributed innovation systems can enjoy competitive advantage with respect to other firms, or groups of firms, who might be wishing to compete in the same product markets. However, there has been no detailed treatment of the actual economic returns to a particular distributed innovation system, or of the distribution of the returns to the individual member organisations within the system. Nor has there been any treatment of how this pattern of returns might change over time and influence the *dynamics* of a distributed system.

These three issues (or sets of issues) might be referred to for shorthand purposes as the system *co-ordination* problem; the system *scope* problem; and the *competitive dynamics* problem. It is our intention in this work use a combination of conceptual development *and* empirical work (see sections on biotechnology and e-commerce below) in order to make substantial progress on these problems.

***Theme 2: Competing Concepts of Competition (lead directors are Coombs, Metcalfe)***

This theme is based upon an approach to the analysis of competition which links closely with the two other CRIC themes (distributed innovation processes and market institutions and the formation of demand). DIPs shape the pattern of innovation and competitive performance and competitive processes shape the institution of DIPs. In particular, the fact that innovation is carried out in distributed fashion through networks of interacting firms and organizations in services and manufacturing, and that the relationship between suppliers and users is crucial to the innovation process, jointly mean that innovation networks closely interpenetrate with market networks. From this emerging perspective we have developed a challenging conceptual programme of work to interact with the empirical parts of our programme. Our aim here is to develop a genuine economic sociology of the dynamics of modern

knowledge based economies. The main elements of this are defined in terms of the following strands.

- **Contrasting Economic, Sociological and Managerial Perspectives on the Competitive Process.** This strand will seek to compare, contrast and, where appropriate, synthesise the many perspectives on competition arising from these different literatures and others including economic geography. It will provide a comprehensive statement of current understanding and its development in different disciplines. A comparison, for example between the work of scholars such as Krugman, Storper and Porter, or between Nelson/Winter and Humbolt would be very instructive. This will provide important background material for the CRIC programme, it will enable us to engage constructively with other disciplines outwith the innovation literature and it help link our work with the strategy and policy literatures.
- **Complexity and Competition: Strengths and Limitations of an Adaptive Evolutionary Approach.** The complexity approach views the economy as a complex adaptive system. Characterised by computer based modelling and simulation of economic agents and behaviours, it provides an alternative framework for examining how various types of microeconomic structures lead to particular aggregate behaviour. The dynamic of the competitive process is one in which economic agents (individuals, firms, markets, regulatory institutions) continually adapt and co-evolve both as a response to feedback from and in an attempt to shape the environment. This strand will seek to apply the ideas and concepts from the rapidly developing literatures on complexity and adaptation to the theory of competition and development. It will connect the CRIC work with the wider study of economic growth and innovation in knowledge-based economies.
- **Competition and the Growth of Knowledge.** The final aspect of this research agenda is its emphasis on the connection between the process of competition and the development of knowledge. This is one of the most challenging aspects of our work but it is one that provides important links to the study of economic growth, the contribution of science and technology policy and the nature of the knowledge based firm. This theme applies not only to the development of formal knowledge but equally to the less formal knowledge of organisation and market demand. Thus it provides a bridge with our work on distributed innovation processes, on outsourcing, and on the construction of markets. There are also important connections with an emerging body of work on complex adaptive processes and the relation between innovation and competition.

### ***Theme 3: Consumption and Innovation (lead directors are Warde, Miles)***

The principal aim of this long term theme is to develop a theoretical and substantive account of the relationship between social and economic change and patterns of consumption and demand. Among its key objectives are:

- to consolidate and refine a conceptual framework for understanding the relationship between production and consumption, that places particular emphasis on the logic of the different social practices that consumers engage in and the significance of time and temporalities in the consumption process.

- to explore and evaluate the role of different techniques for predicting demand and for formulating new ways to sell products to final consumers in the process of forming innovation strategies.
- to develop a substantive account of the relationship between social trends and patterns of consumption and demand, which is historical, which identifies the routine element of consumption practices, which relates to the impact of changes in work on consumption and everyday life, and which deals simultaneously with the formal and informal economies.
- to evaluate competing explanations of taste and preferences in the economic, sociological and managerial literatures, with particular reference to the effects of differential resources (especially social capital) and trust and mistrust on the consumption of innovative products. We propose to make use of a network analysis perspective.

Thus, with a particular interest in the effect of final consumption on innovation and competition, we seek to explore comparatively the development of mass and niche consumption (initially with special reference to food and food services). We seek to compile a database of information about European trends in household expenditure and adoption of innovative products and to subject this to secondary analysis. There are considerable technical difficulties in this task, but the pay off in terms of understanding the relationship between social change and consumption behaviour will be significant.

### **Empirical Probes**

In this section we sketch two of the empirical probes which are the most developed aspects of our empirical programme to date. We have chosen to work in ICT and Biotechnology because they are fields in which the rates of innovation are amongst the highest in the economy, their long term significance for the UK is enormous, and they exhibit some of the most novel *modes* of innovation in the economy. This latter point is important given our conceptual focus on changing modes of distributedness in innovation, and in the relationships to competition and consumption. We are also developing similar probes in relation to medical innovation (e.g. innovation in relation to the delivery of ophthalmic services), environmental innovation and innovation in respect of the food industry.

#### ***Biotechnology: Genetic Modification of Plants***

Over the next three years a major project will be undertaken in the field of biotechnology and genetic modification of plants. The programme as a whole spans and integrates all three of CRIC's major themes, but there are three major components to the programme which give a specific focus on DIPs, competition and markets, and demand/consumption.

Building on research already undertaken in CRIC on the genetic modification of tomatoes, and the world's first GM oriented towards processing and product, and on work carried out for the DGRC on the future of UK's biotechnology capacity, the

programme will be comparative, with North-South, and East-West axes. Links have been established with the Technology and Agricultural Development group at the University of Wageningen, in order to undertake this comparative work which will take the US, China, Africa, Brazil and Europe as its empirical fields.

The BBSRC funded John Innes Centre, Europe's largest plant biotechnology research centre has expressed willingness to participate in the project.

The project will explore:

- GM Market formation, global, regional, and local in relation to firm scale and activity
- Public and private interactions from fundamental research through to final product development
- Firm to firm interactions, especially between different classes of economic agent (e.g. biotechnology, seed manufacture, cultivation, processing, retailing)
- The nature and structure of funding (private internal resources, external governmental, European and charitable resources)
- The formation of regulatory environments at national and supra-national levels
- The institutionalisation of IPR in the area of GM and the formation of boundaries and traffic across boundaries between private and public knowledge
- Public debate and lobbying organisations, and the role of these in the formation of demand and the shaping of markets.

In terms of CRIC's three themes the project is divided into three specific areas of GM technologies and development, defined by the different end markets towards which the GM technology is oriented. In each of the three areas, the intention is to choose one GM trait or technology as the basis of comparative research, and these are *provisionally* indicated below.

- *Competition and markets. Agro-oriented GM markets.*  
This looks at a GM technology aimed at modification for the purposes of enhancing agricultural yield or crop quality, through disease or pest resistance, stress tolerance (climate, soil), or plant characteristics (e.g. dwarfing). The technology provisionally accepted is the already widespread Bt corn and maize, with resistance to bore weevils.
- *Consumption and demand. End market oriented GM.*  
Here the focus is on modification of the crop for the purposes of enhancing the nutrient characteristics of the crop. There are many examples of vitamin, protein, antibiotic, or other pharmaceutical properties which result from genetic modification. There are major issues of epidemiology, national dietary cultures, and the nature of consumer demand and resistance involved. The example of 'golden rice' with Vitamin A enhancement appears a strong candidate.
- *Distributed innovation process. The formation of knowledge markets.*  
One of the most dynamic areas of development in the sphere of GM technology is the changing interactions between private R & D and public science infrastructure,

on the one hand, and the changing configurations of firms, and emergence of new classes of firms, on the other. A key issue in this area is the different levels of IPR, from the most generic at genome level to the most specific at single trait expression level. How firms combine or integrate over these levels, and the way they interact is very fluid and rapidly changing. The project would thus take bio-informatics and genomics as a focus of knowledge market formation, with the rice genome as a strong candidate for the specific empirical object.

### ***Information and Communication Technology and the E-Economy: The Leading Edge of Service Innovation?***

The listing below of areas which we consider to be particularly fruitful in the context of CRIC's research agendas and is intended to be indicative rather than either exhaustive or definitive as concerning our future efforts. If our analysis is correct, E-commerce will profoundly influence the economic and social basis for distributed innovation processes, new forms of competition and consumption behaviour, offering numerous possibilities for CRIC research.

We categorise our planned projects under the three long-term themes with brief examples of the issues to be addressed:

#### *Distributed innovation processes*

The development of e-commerce is by definition a distributed innovation, requiring some measure of concerted action among several, often many, players. We plan to investigate this by looking at both the creation of new electronic markets by multiple actors and by researching the new opportunities for distributed innovation offered by electronic environments:

- New “electronic marketplaces” are currently being forged in many sectors by alliances of large purchasers, retailers and producers. The construction of these new marketplaces is itself an innovation and the processes and impacts of their implementation are of considerable interest.
- In addition, the e-commerce innovation process is often one that calls into play a surprising number of KIBS in support of the adopter, e.g. website designers, software programmers. The dynamics of these new industrial clusters are very poorly understood, yet they have considerable significance for national, regional and sectoral innovation systems and development processes.
- E-commerce represents a potentially powerful means for facilitating distributed innovation. The cost and risk of forging new alliances and the potential for the rapid development of communities of innovation and practice offer a profound effect on the nature and efficiency of DIPs.

#### *Forms of competition*

It is clear that the development of particular forms of electronic market have different patterns of cost and benefit for different players. New forms of competition will emerge from specific processes of institutionalisation. These will enhance the

information processing role of market arrangements and the greater transparency and comparability of price- quality relations will speed up the competitive process and place a premium on the ability to create sustainable competitive advantages. We intend to explore:

- The implications of new government policy (especially with respect to competition and consumer protection), and of the protocols and standards developed by firms and other economic agents, on the emerging structure of new electronic marketplaces.
- The ways in which different types of electronic marketplace can enhance or limit competition, and the analytical tools that are required to understand these processes – and formulate appropriate recommendations for policy – more clearly.
- The development of new market forms to challenge established retailing, wholesaling and logistic structures.

### *Consumption*

While great efforts are underway to reconfigure relations (and even blur the differences) between consumers, suppliers (retailers and manufacturers) and a range of “infomediaries”, there is evident need to understand many features of consumer and consumption practices to make sense of the possible outcomes. We intend to examine the following:

- The social construction of consumer trust in electronic environments. Contrary to the largely technical focus of most commentators, we will explore the social basis of trust formation. “Trust” has many more dimensions and characteristics than appear to be identified in the predominant technical and economic discourse around e-commerce, and we intend to bring a variety of other modes of analysis to bear on examining the interplay between (different forms of) trust and distrust.
- Recent developments in the sociology of consumption have highlighted the need to explore the routines of shopping and the ways that products bought and used by consumers. Ethnographic work applied to the study of e-commerce and consumption can shed light on the processes through which buying decisions are made and the ways in which products gain importance within the household and beyond.
- How e-commerce is changing the retailing of computer games hardware and software for established gaming companies, gaming start-ups and companies using e-commerce to move into the sector for the first time.

### *Using Innovation-related Data to Re-conceptualise Economic Change*

CRIC’s distinctive intellectual agenda has to date largely been pursued by a combination of traditional research approaches – in addition to case study work using interviews and archival analysis, studies have undertaken secondary analysis of official statistics (e.g. input-output data), and specialised studies (innovation surveys). This has helped CRIC become established as a centre where the quantitative analysis

of services innovation and distributed innovation processes is being pushed forward, and we anticipate that in our ongoing work we will continue with these lines of study. Our approach in this work will draw on two specific CRIC resources in order to attack a particular type of problem. The two resources are:

- Specific analytical skills of CRIC staff in the areas of statistical analysis and modelling. These skills include: the handling of large data sets; the use of advanced modelling techniques from both the standard statistical packages and also the less-well known packages such as PRINCALS; and the use of more novel and emerging techniques, especially computer analysis of network relationships. The use of all of these techniques is set in the context of a group of staff who combine the analytical skills with a wide-ranging knowledge of the relevant questions to ask from the standpoint of innovation research.
- Access to data sources which are uniquely valuable for this type of research. For example, we have already had early access to CIS2 data because of commissioned work for the EU and the DTI. There is still further work to be done with this data. CIS3 will be conducted during the next phase of CRIC's funding, and we would hope to be equally deeply involved in the analysis of this data. Also, we have privileged relationships with the Design Council and the CBI which allows access to their data. More generally, we are actively exploring the scope for utilising secondary data, generated for quite different purposes, as empirical material for our agenda. For instance, studies of labour force and skill issues are being brought to bear as a tool for examining distributed innovation processes and the roles of KIBS as well as examining the employment implications of innovation. We intend to continue to examine the use of consumption data sets (e.g. BHPS) to address issues related to the diffusion and patterns of uptake of consumer products. Other secondary statistics will almost certainly be harnessed to our themes.

The individual pieces of work conducted with particular data sources and techniques are valuable in themselves, as has been shown by our previous work. But their cumulative value is that they are allowing CRIC to frame and address a more *generic problem*, which underlies this strand of work. The problem is that the historically received ways of collecting and organising economic data (and also to some extent more recent collection of innovation data) simply do not correspond with the key concepts in our emerging understanding of economic and innovation processes. To cite a few examples:

- Traditional models of industrial sector (defined in terms either of generic product types or manufacturing processes) are still the primary frame of reference for official data collection and analysis. Yet this does not provide an easy point of entry for analysing *distributed* innovation (or production) processes. Nor does it provide a route into quantifying the analysis of, for example, the notion of 'clusters' which is animating some current policy debates on innovation.
- Services and Manufacturing are still treated as 'grand sectors' in statistical presentation of the economy, even though our work and that of many others has shown that these distinctions, *as applied to sectors*, actually obscure more than they reveal.

- The insights derived from using complexity theory to analyse economic transformations will produce new indicators of the connections between structural change and economic growth.

Consequently, CRIC's work in this field will have the long term ambition of contributing to a debate with official agencies and other academics on *new approaches to the conceptual underpinnings of data collection and analysis* in modern, knowledge-intensive economic systems.