

1C3 Japan's Use of Government-Sponsored Collaborative Research to Promote Its Computer Industry : Lessons for the West?

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Introduction

To many Western observers, it has seemed that collaborative research schemes organised by Japan's Ministry of International Trade and Industry (MITI) have played an important role in the country's rapid development of its computer and semiconductor component industries. Japan's 1981 announcement of its Fifth Generation Computer Systems initiative prompted a number of Western attempts to match Japan's competitive performance by using "Japanese-style" collaboration to support research in the various constituent areas of what has come to be known as information technology (IT). However, there is evidence to suggest that many of these Western schemes failed to take full account of way in which the Japanese initiatives actually operated, nor did they pay appropriate attention to special features associated with the structure and practise of business in Japan. Moreover, there have been significant changes in the orientation and structure of MITI's initiatives. In particular, the Fifth Generation Computer Systems project of the 1980s was a very different entity from the widely-acclaimed Very Large Scale Integration Project of the 1970s, and attempts to match the performance of the latter by imitating the former are likely to be disappointing.

The present paper argues that the use of collaboration as a "market modifying mechanism", should take account of the complex nature of market structures and the ways in which these structures vary between different national environments. Japan's collaborative schemes evolved gradually and their development has been shaped by many factors that are specific to industrial circumstances in Japan. If these factors are ignored, there is a strong possibility that attempts to abstract the Japanese collaboration model and transplant it to different national environments will suffer from adaption problems and a failure to function in the way that was intended.

Western Perceptions of Japanese Initiatives

Western awareness of Japan's role as a leading exponent of effective interventionist policies to support its computer industry increased dramatically during the late-1970s. At that time, there were signs that Japan had started to draw level with the United States in certain areas of computer hardware and semiconductor component technologies. To many in the West, it seemed that close cooperation between the Japanese state and

the computer and semiconductor components sectors had coincided with dramatic improvements in "revealed industrial performance". MITI's computer-related ERAs had become synonymous with success. The fact that the Fifth Generation project was also going to be collaborative raised the spectre of extending this momentum of sustained progress into a new area of basic research. Suddenly, it seemed that the West's view of collaborative research had changed. Instead of being seen as a rather peripheral activity, collaborative research became "fashionable" and emerged as a key ingredient in a number of European and US ventures to promote competitiveness. However, many Western-style attempts to imitate the perceived success of Japan's cooperative schemes ("fighting fire with fire") do not appear to have taken full account of several key points relating to the practical operation of "Japanese-style" collaboration. Little importance seemed to be attached to the fact that the structure and objectives of MITI's ERAs evolved gradually and were continually redefined as a consequence of a frequently-turbulent dialogue between the government and participating firms. There were failures as well as successes. Over the years, modifications were introduced as part of an evolving process to correct past problems and react to changes in technological and market environments. Structural variations have included shifts in the respective level of government and industry funding; differences in the duration of projects and shifts in the mechanisms for knowledge sharing. At different times, the Japanese models of collaboration have varied between a clear division of labour, based on self-contained "modular" work programmes, and the joint creation of knowledge in a central research laboratory staffed by researchers seconded from collaborating firms. This has reflected a shift away from "near market", application-oriented schemes (where commercial sensitivities necessitated a degree of modular organisation) and towards the more basic research of the type conducted under the Fifth Generation Computer Systems project.

Japan's collaborative schemes have evolved against the background of significant advances in the ability of Japanese firms to operate effectively in the global arena of competition. This, in turn, has had implications for the extent to which MITI can act as an "honest broker" and "legitimate" agent for mediating between rival firms. In this respect, it could be argued that improvements in the international competitiveness of Japanese firms undermined the significance of MITI's role of providing support at the national level. At the same time, there does not seem to be any industrial consensus about the shape and direction of a "new role" for MITI. Catching-up with the West removed the "technological signposts" that had assisted in the formation of a government-industry consensus for the design of past, "application-oriented" schemes. Basic research is typically concerned with fostering long-term "creativity" and is often prone to drift away from the more rigorous disciplines that are imposed by firms' "current commercial commitments". Companies that are actively involved in the conduct and exploitation of basic research find it hard to generate accurate "visions" for the future. The need to cover the "technological waterfront" means that much of the research work will eventually lead to

benefits that are only of limited or indirect value. It is difficult to produce sharply-focused research agendas that are capable of close correlation with the future evolution of "user requirements". Such a task is even more difficult for government agencies.

As the Fifth Generation project progressed it started to become clear that alternative approaches to parallel processing also showed considerable promise -- although these lay outside the relatively rigid research agenda of the project. In 1992, Nikkei Business reported on tensions between the government and participating firms. Although the firms did not criticise the project openly, the article claimed that there was mounting dissatisfaction with this form of collaborative research initiative (Nikkei Business: June 29, 1992). In this respect, it is interesting to note that MITI's successor initiative, the "Real World Computer Programme" involves a diversity of strategies directed to producing basic research outputs (as opposed to a "next generation" computer).

Differences Between "National Innovation Systems"

Markets are very complex structures. Moreover, the nature and dimensions of complexity vary considerably between different national environments. While it could be argued that "national innovation systems" perform broadly similar basic functions, in the sense that they translate technological knowledge into commercial products and production processes, there are considerable differences in the way in which different innovation systems perform these functions. In particular, substantial variations exist in the relationship between private firms, governments and bodies contributing to aspects of "public domain knowledge" that are relevant to technological development (eg universities and similar institutions).

During the late-1950s, the Japanese government was quick to realise the potential benefits that could arise from the development of a computer industry and the possibility of technological spill-over into related areas such as telecommunications. Policies were initially directed towards creating economic "space" for the basis of a computer industry to be established in the face of an overbearing competitive treat posed by IBM. The use of US-style military procurement to assist in this objective was precluded by a post Second World War ban on defence-related exports. Since direct foreign investment ran against Japan's tradition of self-sufficiency, the relative status of collaboration was higher on the agenda of policy options than might otherwise have been the case. Even then, collaboration was only one of several policy measures. Moreover, the building of a "collaborative culture" did not occur in an instant but rather as the consequence of a gradual learning process, which took place over a series of projects. Strong competition between the firms was accompanied by a sometimes less than harmonious relationship between the industrial sector as a whole and the government. Attempts by MITI in the early-1970s to restructure the industry into a few "national champions" were strongly resisted by the firms and in the end did not take place.

Thus, a drift towards monopoly which is generally restrained by legislation in the West (eg through US Anti-Trust Laws etc) was constrained by the competitive instincts and independence of Japanese firms.

Given the extent of competition between Japan's IT firms, it is perhaps appropriate to ask why initiatives such as the VLSI project were apparently so successful. In prospect, the firms were reluctant to participate in a venture that could compromise their independence. Yet the degree of government funding was high enough to mean that non-participation would place firms at a commercial disadvantage relative to participating firms. This commercial incentive was accentuated by the project's "near market" orientation. Although there was a central facility which provided for an environment for shared knowledge creation, this was mainly concerned with more basic research. The bulk of the project's commercially-oriented development work was organised on a more "modular" basis, enabling firms to internalise the benefits of government-sponsored research without compromising their competitive positions. Commercialisation of project outputs was helped by effective internal communication channels that exist between different sections within Japanese firms. Against the background of Japan's stable industrial structure, the project could be thought of as an example of the government providing a "balanced subsidy" to rival firms, rather than creating a mechanism for sharing the risks and uncertainties of research. These uncertainties were in any case already limited by the fact that the "window of commercial opportunity" for the technology had already been opened by leading US firms and the direction of technological development was well signposted.

Once Japan started to catch-up with the West, the position began to change. One dimension of MITI's response was a move towards collaborative basic research projects. The Fifth Generation Computer Systems Project was a major departure from the preceding applications-oriented ERAs. In some respects, it could be seen as an attempt to build a basic research component into an innovation system which did not have a strong tradition of links with university research. Its achievements have not been closely correlated to the evolving agenda of participating firms' commercial requirements and the translation of outputs into competitive advantage is likely to be an indirect process. Many aspects of the project's work have entered the public domain and have a status which is not altogether unlike that of academic work conducted in Western universities. The Real World Computing Programme is a further extension of the use of collaboration to promote inter-firm, "close to the public domain" basic research. In this respect, collaboration is being used to foster the development of a new research network.

Given the very particular nature of the circumstances under which collaborative research promoted the competitiveness of Japanese IT firms, it is perhaps hardly surprising that the West's attempts to use the concept as a means for matching the dynamism of the Japanese economy have not been without their problems. It was the application-oriented ERAs organised on modular basis that were most closely associated with promoting industrial competitiveness. The Fifth Generation Project's use of shared

private industry had fostered the development of a potent "national innovation system" (as indicated by notions of "Japan Incorporated"). Western concerns about the apparent achievements of this innovation system were a major factor in causing Japan's 1981 announcement of its Fifth Generation Computer Project to send shock waves reverberating around the world IT industry. It seemed that Japan's innovation system was about to be trained on a new target: advanced research.

Whereas previous policies to assist the Japanese computer industry had been concerned mainly with transferring existing technology to Japanese firms, progress towards "fifth generation" computing was to be research-driven. The 10 year project began in 1982 and was directed towards uncharted territory, beyond the prevailing forefront of international best practice research. Fifth generation computers were intended to exploit parallel processing to produce machines that would understand spoken instructions, emulate human reasoning and explain how conclusions are reached: thereby providing a practical realisation of sophisticated artificial intelligence (AI). Although estimates of the ultimate tractability of this ground involved considerable uncertainty, the West's fear was Japan might be able to use its "national innovation system" to create an ability in an area of AI which had suffered a credibility crisis in the West caused, in part, by the over optimistic claims of enthusiasts for the discipline. Irrespective of the its eventual outcome, the fact that Japan was prepared to launch such an initiative was acknowledged widely as being a clear signal that the country had reached a position where it could mount a serious offensive on the very frontier of international best-practice, advanced IT research. The Fifth Generation programme was used extensively by Japan's competitors as a justification for giving more support to IT by promoting so-called "pre-competitive" collaborative research.

Although Japan has implemented a range of different policies to support different aspects of IT, one model that captured the West's attention was the system of Engineering Research Associations (ERAs), organised by the Ministry of International Trade and Industry (MITI). These ERAs, which were initiated in the early-1960s, involve government support for "horizontal" collaborative groupings that allow competing firms to pursue a specified agenda of research on a temporary basis. During the late-1970s, the widely-acclaimed success of collaborative initiatives, such as the Very Large Scale Integration (VLSI) project, helped to reinforce the idea that MITI's ERAs had a major role to play in helping Japanese firms to become more competitive. It seemed as if the government had conspired with industry to exploit the paradoxical notion of "collaborating to compete". Japanese firms appeared to have become competitive by colluding in government-sponsored initiatives to suspend the concept of competition during the development phases of technology life-cycles. There was growing support in the West for the diagnosis that Japanese collaborative research "worked", although details of the design and implementation of these schemes received rather less attention. While the exact extent of MITI's contribution to increased industrial competitiveness is a matter for debate, it did appear that MITI's "vision" for

knowledge creation was a radical departure from previous practice.

Conclusions

While problems with exploitation are likely to be difficult for pre-competitive collaborative research programmes in any national environment, it does not necessarily follow that such initiatives are without value. New networks of the sort being pioneered in Japan's Real World Computing Programme can be stimulated by such programmes. These networking benefits are a feature of national programmes in Europe and pan-European initiatives. Similar outputs have also been exhibited by collaborative schemes in the US. Such networks are of special importance to countries in which there is scope to extend the role of public sector research to cover a greater part of the national innovation system. Britain and the US, which have a strong academic research base in IT-related sectors, have both used cooperative research to consolidate their national knowledge systems. During the 1980s, Anti-Trust restrictions were relaxed in the US, thereby articulating a fundamentally new attitude to competition. Federally supported initiatives such as Sematech are also being commended to the Clinton Administration as policy models for improving the national innovation systems. Trans-national links across Europe have also helped to unite disparate resources. However, the construction of these new communication infrastructures does not solve the problem of how best to proceed into the unknown territory of research-driven innovation. While they can provide an effective tool for supporting national and international knowledge creation, claims that they will automatically strengthen competitive performance should be treated with caution.

During the period when Japan's computer industry was catching-up with best practice Western technologies, the government's policies were often effective in minimising the effects of competitive disadvantages which confronted Japanese firms. Since the early-1980s, the Japanese government has faced the problem of producing policies that foster national competitive advantages. Governments in such a position are not usually well placed to "pick winners" and Japan's approach to supporting the IT industry now features a substantial element of basic research: thereby reflecting a long-established theme of policies practised in the West. Understanding future patterns of innovation will require a deep appreciation of how IT firms' organisational knowledge creation processes interact with evolving technological and market systems at national and international levels.