

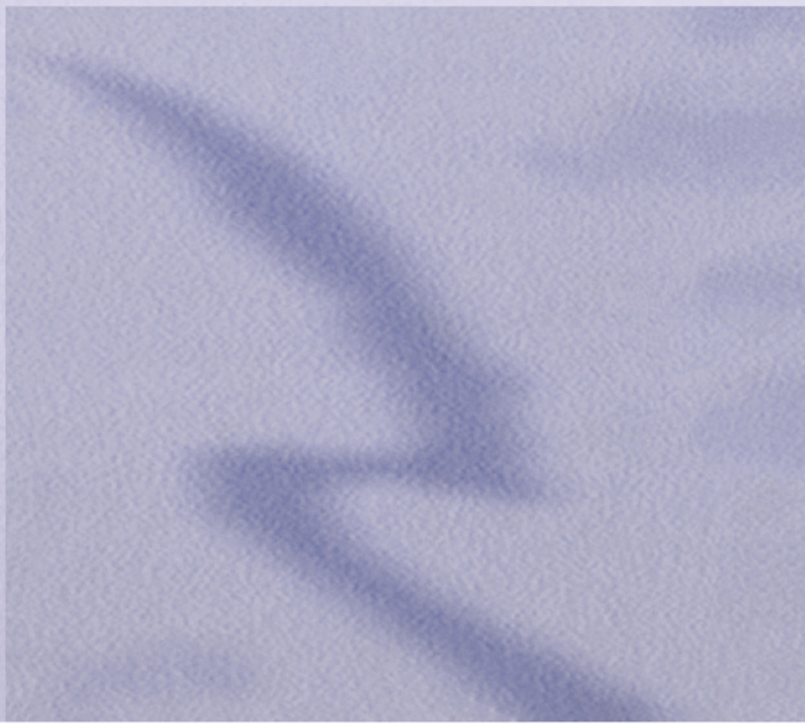
# Technology, Culture and Competitiveness

Change and the world political  
economy

*Edited by*

Michael Talalay, Chris Farrands and  
Roger Tooze

Technology and Global Political Economy



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## Technology, Culture and Competitiveness

The course of history has demonstrated the importance of technological change in the military, political and economic arenas. Perhaps more fundamentally, the ongoing and controversial evolution of a global culture and society also reflects the significant influence of technology. Not all of these developments can be attributed merely to technology, and its influence, while profound, is far from inevitable. Nevertheless, it plays a highly significant role in the international political economy—one that has been consistently overlooked and undervalued.

In attempting to give technology a central place in international political economy, this book is arranged into three sections. The first raises the basic issue of how to think about the subject. Four chapters question our ontological and epistemological assumptions and identify two broad and complementary approaches: the instrumental, where technology serves as a tool of power and as an object of policy; and the transcendental, where technology affects our view of the world, our way of understanding, interpreting and constituting 'reality'. The second part brings together chapters that examine a key question of contemporary policy debate: in what sense is technology a fundamental component of international competitive advantage and, consequently, what should international, national, local and corporate policy be in the light of this? The third section provides case studies within the areas of finance, aviation and automobiles.

The central focus of this volume is the importance of technology in international political economy. Within this overall approach, culture, competitiveness and globalisation provide three unifying themes that form a crucial part of the authors' work. This is a challenging and exciting new book for those studying IPE as well as for policy makers and the business community.

**Michael Talalay** was Senior Research Fellow at Nottingham Trent University and is now Principal Consultant in IT with the Butler Group. **Chris Farrands** is Principal Lecturer in International Relations at the Nottingham Trent University. **Roger Tooze** is Professor of International Relations at the University of Wales, Aberystwyth.

# **Technology and the Global Political Economy**

Edited by Michael Talalay

*Principal Consultant, Butler Group*

Chris Farrands

*Principal Lecturer, Nottingham Trent University,  
Nottingham*

Despite its evident importance in our daily lives, technology has too often been ignored as a critical factor in international affairs and in national and corporate policy-making. This series places technology at the centre of explanation in theories of international relations and international political economy, aiming both to alter the way in which scholars and students think about these disciplines and to provide guidelines for policy-makers in the face of ever-increasing technological change. *Technology, Culture and Competitiveness* is the first book in this series.

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# Technology, Culture and Competitiveness

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Economy

Edited by Michael Talalay,  
Chris Farrands and Roger Tooze



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# Contributors

*Philip Cerny* is Professor of International Political Economy at the University of Leeds.

*Chris Farrands* is Principal Lecturer in International Relations at The Nottingham Trent University.

*Vicki Golich* is Associate Professor of International Relations at California State University, San Marcos.

*Keith Hayward* is Professor of International Relations at Staffordshire University.

*Sally Hayward* is EU Research Fellow in the Graduate School of Business, University College, Dublin.

*John Howells* is Lecturer in the management of technology and innovation at Brunel University.

*Gerd Junne* is Professor of International Relations at the University of Amsterdam.

*Ronen Palan* is Lecturer in International Relations in the School of Social Sciences at the University of Sussex.

*Alan Russell* is Senior Lecturer in International Relations at Staffordshire University.

*Margaret Sharp* is Senior Fellow at the Science Policy Research Unit (SPRU) at the University of Sussex.

*Claire Shearman* is a freelance researcher and consultant who has previously worked for the European Commission **DḠV** and as a university academic in the UK.

*Michael Talalay* was Senior Research Fellow in International Political Economy at The Nottingham Trent University and is now Principal Consultant in IT with the Butler Group.

*Roger Tooze* is Professor of International Relations at the University of Wales, Aberystwyth.

*Geoffrey Underhill* is Lecturer in International Political Economy at the University of Warwick.

*Gillian Youngs* is an independent researcher and consultant dividing her time between the UK and Hong Kong.

# Preface

This is the first in a series of books on technology in the global political economy, the aim of which is to mark out new ground in thinking about international relations. Each volume in the series will explore the idea that technology is a powerful force for change, disruption and restructuring in world affairs. Each, while drawing on different perspectives and experiences, will examine the assumption that ‘technology’ is more than just an artefact or a piece of kit, that it is closely interwoven with the culture, social organisation and practices, and political and economic power structures of society. Each, while analysing the particularities of its subject, will also investigate how technological change is a pervasive element in the processes of globalisation and the re-ordering of what is sometimes called the ‘advanced capitalist’ and sometimes the ‘post-industrial’ world. The series aims above all to put technology at the heart of contemporary debates about international relations (IR) in all of its possible meanings, where so much academic literature, while recognising that technology has some place in world politics, tends to relegate it to a secondary role.

To fulfil these ambitious goals, we aim to publish two or three volumes a year. This introductory book raises many of the key themes and debates which the series will explore. It is particularly concerned to bring together, on the one hand, specialists in IR and global political economy as a whole, and on the other, contributors who have extensive expertise in particular sectors or technologies. It also creates a dialogue between authors with a primarily academic or theoretical background and those who have more practical interests or experience. These discussions began with two residential workshops held first at Barnsdale Lodge by Rutland Water in May 1994 and then in Nottingham in September 1994. These produced a lively debate and led to a great deal of re-thinking—and re-drafting—in all of the papers. We would like to thank the contributors for all their very hard work. We believe that they found the process as stimulating an experience as we did, and we hope that the sense of innovative exploration of the issues is reflected to the reader in the quality of the book as a whole.

*Michael Talalay and Chris Farrands*  
*Series Editors*

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*Michael Talalay, Chris Farrands and Roger Tooze*

# 1

## **Technology, culture and competitiveness** Change and the world political economy

*Michael Talalay, Roger Tooze and Chris Farrands*

Technology has often played a decisive role in world affairs. The Roman roads held together the imperial domains. The longbow led to the English victory at Agincourt. The atomic bomb brought to an immediate end the war in the Pacific that might otherwise have dragged on for many months with far higher casualties. The combination of computers and telecommunications has revolutionised the structure of international finance and led to the seemingly dramatic erosion of national sovereignty. The manufacturing processes known as 'lean production' led to fundamental and far-reaching changes in the automotive industry (Womack *et al.* 1990) and certainly contributed to the success of the Japanese economy. The high cost of modern weaponry (notably SDI) was one of the factors that drove the Soviet Union into bankruptcy, bringing about the collapse of communism and the end of the post-1945 global structure. The industrial revolution heightened global inequality and increased by several orders of magnitude national and regional disparities of wealth and living standards (Kennedy 1993).

Indeed, the very fabric of society—the ideas, values and language that constitute it—all now reflect technological change. The printing press and movable type fundamentally altered the course of European civilisation and set it firmly on the road to secularisation. The automobile created a pattern of development responsible for the suburbanisation and strip development of the United States. Ultimately, technological change can destroy one lifestyle and create another. The Luddites tried to stop this process, but they failed; and where attempts to halt or reverse technological innovation have succeeded—as in China with the destruction of the foundries and the navy—the result has often been less than satisfactory in terms of both global power and local welfare.

Today, technology is enabling the creation of a global society. Modern developments in communications and transportation lead to 'one world', where local differences continue to exist but within the context of an ever-spreading global culture. Based on the English language, on Anglo-American pop culture, and on the Enlightenment concept of rationality, this global culture may not be to everyone's taste. Its desirability may be debatable. Its existence is undeniable.

All of these developments stem from technological change. Of course, while ubiquitous, technology is not the sole causal factor of any of them. Nor are its

effects inevitable. The stirrup, for example, did not mechanistically cause feudalism. However, its appearance in Western Europe in the eighth century and its adoption by the Franks under Charles Martel did lead to a number of choices being made that turned what Lynn White (1962) has called a ‘protofeudal’ situation into a fully fledged feudal system. The development of feudalism cannot be adequately explained without acknowledging the vital role of the stirrup. The same logic applies to technology in general. It clearly is not the only factor involved in explaining change. It is however a potent one. Moreover—and herein lies the rationale for this book—it is a factor that has too often been ignored or defined away by those who seek to explain International Relations (IR) and International Political Economy (IPE).

Indeed, it was our growing sense that the burgeoning literatures on ‘technology’ and ‘international political economy’ were *not* adequately informing each other that provided the impetus for this investigation. Although studies of specific technologies and the IPE analysis of ‘high technology’ are clearly of great and increasing importance (e.g. Tyson 1992), it is equally clear that mainstream IR/IPE does not have at present what we regard as an appropriate and articulated framework which acknowledges the key role of technology itself as an integral part of the theory and practice of the world political economy. This is not to say that IR/IPE has ignored ‘technology’. Indeed, as Ronen Palan demonstrates in the second chapter of this volume, the core of IR theory has been constructed around a series of (generally implicit) technological metaphors, and hence technology *per se* has been and is fundamental to theorising IR/IPE. But we would say that technology, where it has been thought important, has generally been explicitly analysed in a specific and narrow way. Technology has been defined by the discourses of IR/IPE as a particular and limited material phenomenon, largely to be treated as an exogenous and given factor—and hence all too often ‘black boxed’ (Rosenberg 1982)—and at the same time largely to be viewed as instrumental—as a tool or as an object of policy. Our unease is shared by others in IPE, notably Susan Strange who has consistently argued for a greater focus on technology and who recently observed that any real understanding of markets ‘requires some sensitivity to the implications of rapidly changing technology—an aspect of political economy that social scientists...persistently overlook’ (Strange 1994b: viii).

Of course, some branches of IR/IPE have almost fetishised certain technologies—particularly the technology of war, weapons and military power—with the associated danger of arriving at explanations/analyses from an implicit technological determinism. While the understanding of the technology of war and military systems is undoubtedly of crucial importance to our continued physical survival, all too often such an understanding has been developed in isolation from broader conceptions of security, welfare, and production (for an excellent attempt to broaden the basis of security studies see Buzan 1991). Other branches of IR/IPE have relied upon the structural changes produced and enabled by technological forces, but have not explicitly analysed these as integral to the international system—particularly the studies of transnational relations and

interdependence in which technology is seen as a key part of the changed environment which produces interdependence (see for example Keohane and Nye 1977). For the most part, and with important exceptions to be discussed later, IR/IPE has not considered ‘technology’ as an endogenous and constitutive factor which forms a necessary part of our explanation and understanding of the totality of the world political economy.

A brief illustration will support this contention. Mainstream IPE consistently alludes to the importance of technology while equally consistently refusing to acknowledge this importance in the analytical frameworks utilised. Both Spero (1993) and Gilpin (1987)—two texts widely regarded as setting out the basis of IPE and very extensively used—chose not to include technology as a major factor of their analyses, and the otherwise comprehensive reader edited by Frieden and Lake (1991b) similarly ignores technology and its role, along with innovation, as a key driver of change. Exceptionally, Walters and Blake (1992) do consider technology as a core element of IPE and important enough to merit one chapter devoted specifically to it, of the nine in their book. This discussion is very welcome and, among other things, serves to demonstrate the problems of omitting such a consideration in the analysis of IPE. However, they focus almost entirely on technology as ‘an objective of foreign policy, a means to achieve military, political, and economic goals, and an instrument to carry out foreign policy’ (*ibid.*: 165). In other words, technology matters to IR/IPE because it alters state power and adds to the agenda and instruments of state policy—not the least because it changes the competitiveness of nationally based sectors of economic activity. This, for us, while a necessary element of the analysis of technology (see [Part II](#) of this volume), is not a sufficient conceptualisation of the relationship between technology and world political economy.

In case this argument is seen only as a comment on the orthodoxy of IR/ IPE, it is just as clear that most of the challengers to the orthodoxy have also not put technology in a central analytical position. Among those who *have* included technology, Susan Strange, who continues to develop the argument that technology has to be incorporated into our understanding of IPE (Strange 1994a), Richard Ashley, whose work includes a reconstructed political economy in which technology constitutes the very language of our experience (see particularly Ashley 1981) and Robert Cox are particularly noteworthy. Cox (1987) has developed a materialist analysis of production in which technology is a fundamental element of the structure of global politics. We would agree with Cox that ‘it is more realistic to see technology as being shaped by social forces at least as much as it shapes these forces’ (*ibid.*: 21), and that ‘technology itself is a product of society and society’s power relations’ (*ibid.*: 313), yet we would wish to take the focus on technology further than Cox—if only to redress its lack of attention in the mainstream. For, despite the efficacy of the analyses presented by the above, and notwithstanding the contribution of the two authors discussed below, mainstream IR/IPE has been woefully slow to develop a technologically inclusive approach or to recognise the importance of technology in providing language and metaphors of theorising.

There are two recent and important exceptions to the general lack of attention given to technology in IR/IPE. Perhaps the most comprehensive attempt to elucidate the ‘subtle and fascinating relationship between international affairs and science and technology’ is that by Eugene Skolnikoff (1993: ix). This analysis offers very real gains in our understanding of the relationships and structures involved and of the complex interplay of science, technology, economy, society and polity at the international level. It is, however, constructed on the basis that ‘the fundamentals of the nation-state system have not been altered as much as most rhetoric would lead us to believe’ (*ibid.*: 7). That is, it is a state-centric analysis. For our purposes this framework and conclusion are limiting—we would wish to posit structural changes that *do* alter the ‘fundamentals’, but in ways that make it very difficult to recognise and conceptualise using the framework of conventional, state-based political analysis. What, however, is of the greatest significance is that Skolnikoff treats technology, not as an external given, but as a dynamic, integral and *constitutive* element of the international, and concludes, not surprisingly, that ‘theorists must more adequately recognise the dynamic and subtle nature of the interaction of science and technology with international affairs’ (*ibid.*: 246).

A second significant contribution to the understanding and role of technology from within IR/IPE is James Rosenau’s iconoclastic and innovative study of systemic change and world order, *Turbulence in World Politics* (1990). Rosenau argues that technology has been one of the principal forces bringing about a fundamental transformation of world politics—in direct contrast to Skolnikoff’s claim of evolution rather than structural transformation. For Rosenau, technology is the major factor of explanation in his evolution of the notion of the ‘Two Worlds of World Politics’—the ‘State Centric World’ and the ‘Multicentric World’. In terms of the sources of change driving turbulence, he argues for multiple causes, but ‘all of them are seen as being initially responses to the technological upheavals that underlay the ever-growing interdependence of economic, political, and social life’ (*ibid.*: 15). He identifies three dynamics as exogenous sources of global turbulence, but technology is the most powerful. ‘It is technology...that has fostered an interdependence of local, national, and international communities that is far greater than any previously experienced’ (*ibid.*: 17). We support Rosenau’s arguments of the centrality of technology in explaining global change, but we differ in our emphasis that technology is *not* an exogenous force and has to be incorporated as endogenous to political economy. And where Rosenau often tends to treat technology as a given, we return to Cox’s notion of technology as social product, only understandable within the context of particular structures of political economy, in other words endogenous and not exogenous.

There is, then, a clear and important theoretical and ontological lacuna in IR/IPE which has been exacerbated by the contemporary social construction of knowledge into science/non-science and its continued reflection and reproduction within and by academia. This tends to reinforce the notion of technology as artefact, or machine, and the production of this artefact as an

autonomous phenomenon, driven by the logic of scientific and technological possibility, rather than the more persuasive view (we would claim) of technology as a social phenomenon, only understandable within the broad context of the patterns and structures of political economy, and particularly its liberal-democratic, capitalist forms in the late twentieth century.

Nor is the lack of analysis and theory helped by recourse (in classic IR fashion) to borrowing from the discipline that one might expect to have developed the most extensive and integrated analysis of technology and its generation/impact—economics. The field of economics has shared with IR/ IPE a marked reluctance to engage with the nature of technology and related social processes. The profession of formal economics has by and large restricted analysis of technology to its impact on the production function, and has conceived of technology itself in a very limited sense:

Economists have long treated technological phenomena as events transpiring inside a black box. They have of course recognised that these events have significant economic consequences, and they have in fact devoted considerable effort and ingenuity to tracing, and even measuring, some of these consequences. Nevertheless, the economics profession has adhered rather strictly to a self-imposed ordinance not to enquire too seriously into what transpires inside that box.

(Rosenberg 1982: vii)

Consequently, it is not possible or indeed desirable to turn to orthodox economics for insight; nor, it seems, can we gain improved understanding from texts on international economics, which generally reinforce the conventional restricted economic view:

An improvement in technology means that a larger output can be produced with given inputs of the factors of production. If the supply of these factors remains unchanged, such a technological change means that the production-possibility curve shifts outward to the right.

(Ingram and Dunn 1993:105–6)

While this may be true, it hardly exhausts the range of important questions that need addressing on technology!

To find greater emphasis on the role of technology, we need to turn to other broad social sciences—to political economy, to Schumpeter and the long wave theorists, to the literature on business studies (very broadly defined) and to a small but significant number of recent studies that bring together economics and technology (for example Dosi *et al.* 1990). However, as useful and important as these literatures are, none fully reflects and addresses the agendas and concerns of IR/IPE.



## ELEMENTS OF A TECHNOLOGICALLY INCLUSIVE IPE

Rather than work towards a highly specified theoretical model of IPE, which carries greater risks of conceptual exclusion, our view is that it is more profitable to establish certain elements of an ontology of a technologically inclusive political economy. Here, we use ontology in the sense meant by Robert Cox when he writes:

Ontology lies at the beginning of any enquiry. We cannot define a problem in global politics without presupposing a certain basic structure consisting of the significant kinds of entities involved and the form of significant relationships among them....There is always an ontological starting point.

(Cox 1992:132)

A technologically inclusive ontology could (and should) form the starting point for the analysis of world political economy. We suggest that such an ontology should have, at least, the following elements.

The first element should identify what is included/excluded by the term 'technology'. As with any word, meaning changes with time, space and culture, and the values, preferences and language structure historically embedded into the word 'technology' are of fundamental importance. It is therefore not appropriate to seek a universal definition, as any such definition would be arbitrary. We should rather identify the broad contours of meaning and practice within specific and concrete historical structures. Skolnikoff provides a good starting point for contemporary usage when he uses the work of Harvey Brooks (1980:66, quoted in Skolnikoff 1993:13) to define technology as 'knowledge of how to fulfil certain human purposes in a specifiable and reproducible way' and hence, elaborating on this definition, that 'technology...does not consist of artifacts but of the...knowledge that underlies the artifacts and the way they can be used in society'.

This point is important for IR/IPE—technology is a form of knowledge, and consequently, from this conception of technology, the generation, ownership, use and control of such knowledge lies at the core of IPE (see, particularly, Strange 1994a). Further, a wide range of knowledges constitute 'technology', not just knowledge concerning material production: 'What might be termed "social" technologies, such as codified systems of management or computer software, are therefore appropriately considered technologies along with those that are physical in nature' (Skolnikoff 1993:14). So the social structures of production and services—specifiable and reproducible organisational forms and behaviour patterns—are equally included in 'technology'. In this sense 'technology' should also include the notion of tacit social knowledge transmitted through informal social processes, interactions and culture. Much of our failure to properly understand the processes of economic transformation (for example in Eastern Europe) stems from an underestimation of the importance of informal knowledge

as a constituent of technology. Margaret Sharp specifically argues the importance of a broad and non-formal notion of technology in this volume:

technology is often complex, multi-dimensional, expensive to implement and specific to a particular firm...a large part of it is tacit knowledge (i.e. passed on by word of mouth and not written down) and derives from trial, error and learning, rather than from the systematic application of science.

(Sharp, this volume, p. 93)

The second element should be an acknowledgement of the intersubjective nature of technology, necessary for both understanding and explanation. This intersubjective element acts as an unarticulated ontology, and '[T]he ontologies that people work with derive from their historical experience and in turn become embedded in the world they construct. What is subjective in understanding becomes objective through action' (Cox 1992:133). Technology has both constructed and informed our experiences and language throughout history. It has shaped our perception of the world, the language we use and how we act in the world. To deny this is unwisely to relegate technology to a purely instrumental role within IR/IPE. And, although that instrumental aspect may be important and may deserve much further analysis (cf. Tyson 1992) it must be considered *within* a historical context and structure itself based on technological change.

Third, we should *explicitly* place technology in a central *practical* role in world political economy, and *explicitly* consider technology as an integral part of the *conceptual* study of political economy. It is endogenous to the problems and issues of IR/IPE rather than merely part of the context or simply an exogenous dynamic for change. As a product of social forces it must be theorised within the historical structures of world political economy. Part of this integral treatment of technology within IR/IPE would be the effort to work towards an explanation of technological change itself. Although such an explanation may not be the key focus of IR/IPE, we do need an adequate conceptualisation of this phenomenon, at the very least to avoid returning technology to its 'black box' but also in order to help formulate practical policy guidelines.

Fourth, a technologically inclusive ontology should treat politics and economics as indissolubly mixed and should regard the boundaries of each as questionable, defined by political practice and interests, rather than having absolute identities. Moreover, it should treat the boundaries and definitions of 'the international' and 'the domestic' in a similar way, as socially produced. Opening up these categories is not easy and is often difficult to sustain in the face of the power of existing ontologies, but is clearly necessary for our purpose here.

The final element is an emphatic rejection of exclusive state-centricity. The state is not an appropriate unit for understanding technology. Organisations—particularly the commercial firm—drive technology. However, equally, the state is in no sense unimportant. Technology needs to be understood within a multi-

level, multi-actor historical context, with the state as one among a range of actors constitutive of the international/transnational system.

We would argue that an ontology of world political economy that included the elements adumbrated above provides a more satisfactory ontology of political economy than existing approaches. Each of the chapters of this volume incorporates one or a number of these elements—they all share the view that technology is necessarily a central part of any understanding and explanation of IR/IPE.

## THE STRUCTURE OF THE BOOK

The book is constructed on three interlinked sets of questions. These questions were arrived at as part of the intellectual process of working through some of the analytical problems with the group of people we brought together to discuss technology and IPE. The first set of questions is primarily about ontology and concepts, relating to how we view the world. The second is policy oriented. The third is more focused on sectors, looking at how specific technologies have changed the nature of the world political economy. Each set of questions relates to the others and draws upon them, but each also provides a valid ‘way in’ to the multi-level issues and complex relationships that characterise technology. In this sense, the book can be read in any order—every chapter has to confront some of the underlying questions, but each uses a distinct empirical frame of reference.

The first set ([Part I](#) of the volume) addresses the basic question of how to think about the subject. Four very different chapters question our ontological and epistemological assumptions. They identify two broad categories, again closely linked: the instrumental, where technology serves as a tool of power and as an object of policy; and the transcendental, where technology affects our view of the world, our way of understanding, interpreting and constituting ‘reality’.

[Part II](#) brings together a number of chapters which address a key question of contemporary policy debate: in what sense is technology a fundamental component of international competitive advantage, and consequently what ought international, national, local or corporate policy be in the light of this? Four chapters look at the ‘positive’ side of this issue while the fifth provides an interesting and highly instructive counter-example: it is a case study in failure.

The chapters in [Part III](#) focus on three core sectors of the world political economy—finance, aviation and automobiles—and ask how technological innovation in these areas has brought about change in the nature of the global political economy, in the structure of the international system, and in the distribution of power among the players in that system. Four of the chapters deal with existing, widely-exploited technologies. The fifth is an exercise in futurology—it addresses a technology with potentially significant consequences but still only in its infancy.

Though the three parts are clearly distinct, a number of common themes and concerns tie them together. One is the concern with the *centrality of technology* if we are to develop adequate notions of change in the world political economy.

Second is the issue of *globalisation*. The prevalence of IT and telecommunications as enabling technologies ensures that ‘globalisation’ will be a major issue in any volume such as this. What, however, does it actually mean? And how does it relate to what appear to be the equally prevalent trends towards tribalisation and localisation? A third common theme revolves around the importance of *culture*. This area has often been, as one of the contributors notes, a ‘missing dimension’ in the field of international studies. Not so in these essays. While their conception of culture may vary, almost all of our contributors discuss its significance with respect to technology in general and more specifically to the influence of technology on international political economy. On the one hand, to what extent do cultural factors influence the shaping of technology? And on the other, how much does technology influence cultural patterns and homogeneity? What makes this particularly interesting are the very different conceptions of what culture is and how its influence makes itself felt. A fourth major theme is *competitiveness*. As IR/IPE increasingly becomes a matter of the ‘low polities’ of trade and commerce rather than the ‘high polities’ of war and diplomacy, the issue of competitiveness grows in importance. Whether on a national, a regional, a local or a corporate level, more and more the question of how can ‘we’ successfully compete is being asked. One of the key answers that emerges from the chapters that follow is that competitiveness depends very much not merely on access to technology but—critically—on the ability to absorb it. This is partly a matter, as some of the chapters make clear, of organisational and institutional structures, but it is also a matter of training and—especially—education. Moreover, there is a close link—again as a number of our contributors point out—between competitiveness and culture. Not only is culture a key element of competitiveness, but also there is a competitiveness among cultures. The transcendental and the instrumental meet in deciding which culture(s) will become the global standard. Here we see the inter-relatedness of our themes—culture, competitiveness and globalisation all mutually affect each other. And all are related to our final theme. This indeed reflects and contains the other concerns—it centres on the core problem of the nature, the locus and the focus of *power*. In what ways has technology altered the nature of power, how it is used, and who has it? In the classic terms of political economy, ‘Who benefits?’



# **Part I**

## **Thinking about technology and international relations**



## 2

# Technological metaphors and theories of international relations<sup>1</sup>

*Ronen Palan*

Our era has become cognisant of the powers of technology. Accelerating rates of technological innovation and rising capital costs are producing an increasingly technology-driven world economy. Technology has become one of the key factors in the new international competitive game (Strange 1988). In the future, we are told, knowledge and technology will divide the 'haves' from the 'have-nots' (Reich 1991).

The implication for International Relations theory (as well as for other social sciences) seems clear. Either face up to the tremendous challenge posed by technology and technological change, or else face oblivion. But placing technology at the centre of IR theory, laudable as it may be, may turn out far more difficult and challenging than we have bargained for. Besides the obvious difficulties which are caused by trying to add additional 'variables' onto existing theoretical frameworks, there are other, more subtle problems.

To begin with, recent discussions of technology tend to overlook the fact that technology is as old as human history. Technology may appear to have been largely excluded from current IR theories. But is this truly the case? Any would-be theorist must first of all grapple therefore with the question of whether existing theories are truly and profoundly free of technological undertones.

Second, and related, as Heidegger (1962), Mumford (1964), Foucault (1972), Bohm (1983) and Prigogine and Stengers (1984), to name a few, have demonstrated, technological advances are founded in broader epistemological and ontological 'breakthroughs'. Technology may present itself therefore as an *object* of enquiry, a means for attaining identifiable goals, but it also informs our epistemology in a way that only a 'constructivist' methodology begins to make sense.

The annals of the social sciences display clearly this dichotomy. Technology is addressed on two separate planes, the one privileging what may be described as *instrumental* thinking, the other privileging *transcendental* thinking. The one is concerned with technology as an instrument, a tool of human advance. Instrumentalist literature tends to treat technology as an undifferentiated but important intellectual ingredient which contributes to national competitive policies. Technology does not have to be always physical in character. Classical antiquity certainly recognised the elements that make up machines and produced



as a result superb war machines and hydraulic pumps, but it developed, crucially, aspects of technology that were non-physical in nature: coinage, alphabetisation, stenography and geometry (Mokyr 1990). In recent literature, the emphasis is on the accumulative nature of human knowledge, and the enormous societal resources that need to be devoted for such an undertaking (see for instance Sally Hayward and Sharp in this volume).

Instrumental thinking can be contrasted with *transcendental reflection*, which is a form of inquiry into the relationship between technology, as a manifestation of human knowledge, and cognition. The latter presents technology not simply as an instrument or a tool, but as a social and hence symbolic activity by which humanity has learned to express itself. Durkheim has argued, in the traditional Kantian line, that all higher organisms possess a biological necessity to create a semblance of continuity and stability (1976). In its quest for making sense of a complicated world, the human mind employs whatever means, metaphors and analogies within its grasp that help it 'understand' its surroundings. So it may be argued that the various strands of human 'understanding', including 'scientific thought', are ultimately far more concerned with psychological security than with cognitive assurance.

Thus we find that historically, physical objects shaped to some extent philosophical reflections about order and change in society. Technological artefacts, in fact, often served as analogies and metaphors by which philosophers sought to explain their surroundings. Explanation and reflection, however, are not neutral. They help shape and transform the very 'reality' which they seek to explain. In this sense the transcendental nature of technology can be never be fully dissociated from instrumental thinking.

Technology therefore is an 'awkward' concept because it is debated contemporaneously on two separate and yet interdependent levels. On the one hand, the debate is on the theoretical status of technology-as-object. The ultimate aim of this exercise is to find a way of slotting the concept within an existing epistemological and theoretical framework. And yet this epistemological ground itself is shifting: questions are immediately raised not only about the object of enquiry, 'technology', but also about the disciplinary framework in which this object is supposed to lie: 'International Relations', 'state', 'policy' and so on. Consequently, as technology changes, so our conceptions of humanity, nature and society change as well. Furthermore, as our perception of technology changes, so our conceptions of the 'international' change with it.

I would like to argue in this chapter that technology has played therefore an important if largely unnoticed role in the development of International Relations theory. For the sake of simplification, I will present the thesis as a sequence of discrete logical derivations in which:

- 1 technological advances take the form of diverse interpretations of what technology is all about;
- 2 these interpretations help shape a broader conception of what the social setting is all about;

- 3 the resulting conception of society then serves as the basis upon which theories of international affairs evolve;
- 4 theories of international affairs then have concrete implications on the conduct of international affairs;
- 5 the resulting theories of international affairs then represent technology in a particular light. The latter defines our instrumental thinking.

This sequence leads me to the conclusion that the so-called third industrial revolution may be at the root of the most profound transformation that International Relations theory has experienced since the end of the Second World War. We are witnessing an inversion in our conceptions of the very problematic of International Relations! Traditional IR theory was implicitly premised on the assumption that the unities, the states, were given and knowable, but the relationships between them were unstable. Now, an inversion seems to be taking place and relationships are perceived to be empirically ascertainable. The problem however is that the unities, the states, are alterable. *Relations of hierarchy and competition are taken to be the essence of the international* (or the global). The focus is therefore no longer so much on what may be gained in the international sphere—how the state/society complex can obtain values—but how identities can be sustained in a ‘turbulent’ world.

Concretely, I will try to establish a correlation between technological advances and three stages in International Relations theory (and practice): the human body and political realism; the systems approach and the rise of interdependence schools; information technology and the growing interest in national competitive strategies.

### THE MECHANICS OF REALISM

It is a delightful irony that ‘political realism’, which prides itself for its anti-idealism, offers such a rich source for a ‘transcendental’ critique of International Relations theory. As I have argued elsewhere, realism is rooted in a hi-tech theory of an age gone by (Palan and Blair 1993).

‘Hi-tech’ machines like organisms and mechanical clocks offered visible evidence of complicated processes that maintain unity in change.<sup>2</sup> They served as readily available analogies that helped shape human understanding of itself and its surroundings. As philosophers began to grasp the incredible complexity of nature, they sought to obtain comparable symmetry and harmony in human society by closely imitating the work of nature. In addition, the experience of an intricate machine like the human body served to underlie the intimate relationships that unite parts with the whole. Nature served as a metaphor for human society. The state has a natural priority over the household and over any individuals among us’, concluded Aristotle, ‘...[because] separate hand or foot from the whole body, and they will no longer be hand or foot except in name’ (1981:60–1). Cicero likened the head of the state to the spirit that rules the human body. Grotius and Puffendorf developed their theories of sovereignty on

the conception of the state as an organism or moral person (Gettell 1924:399) Such metaphorical associations are still discerned in the concept of the ‘body politic’ and its modern biological derivative, the ‘social *structure*’.<sup>3</sup>

From the fourteenth century, machines and automata became the prevailing analogy for intelligent life in Europe.<sup>4</sup> Newtonian mechanics inspired a generation of Baroque thinkers whose views of society were grounded in their understanding of mechanical devices. A number of important and influential treatises from la Mettrie’s *L’Homme Machine* (1748) to Herbert Spencer’s *The Man Versus the State* (1884) debated the finer details of the analogy. The concept of ‘circulation’, for instance, originated in the sixteenth century in the discipline of hydraulic engineering to describe the flow of water. William Harvey viewed blood in similar terms and adopted the metaphor for medicine. Hobbes, following his famous visit to Italy, began to view money in similar terms as well (Gustatz 1983). Blood circulation, money circulation, financial liquidity, appear nowadays as impartial observations of purely descriptive value. But they are not. Money circulation carries undertones of a healthy body nourished by blood. Our understanding of the financial system is therefore closely tied to a conception of a world neatly divided into ‘bodies politics’.

Such metaphorical associations had deeper impacts. The advent of liberalism with its emphasis on ‘individual’ sovereignty coincided with the emergence of the modern sovereign state possessing, it was held, a personality of its own. The homology was celebrated in common mechanical metaphors. Thus Hobbes inquires:

Why may we not say, that all *automata* (Engines that move themselves by springs and wheeles as doth a watch) have an artificial life? For what is the *Heart*, but a *Spring*; and the *Nerves*, but so many *Strings*....*Art* goes yet further, imitating the rationally and most excellent worke of Nature, Man. For by Art is created that great *Leviathan* called a *common-wealth*, or *State* which is but an artificial Man; though of greater stature and strength than the Naturall, for whose protection and defence it was intended; and in which, the *Sovereignty* is an Artificial soul, as giving life and motion to the whole body.

(Hobbes 1951:81)

Society was therefore conceived as a higher organism. Whether the organisms, humans and societies alike, were spiritual unities or mere mechanical articulation of parts, was at the core of a dispute between religious scholars and the secular movement. But the notion of a sovereign community, or the ‘state’, as a separate and internally differentiated functional social body, became well entrenched.

Persistent use of organic and mechanical metaphors perpetuated the perception of a world divided among well organised bounded communities. The ‘reality’—although such terms appear alien in this context—was far from it (Hall 1986). But the conceptual interdependence between organisms and societies did not stop there. Just as humans were provided with critical faculties for rational thought, so

the state was thought to possess its innate cause: the celebrated notion of the 'reason of state'. And just as individuals employed their faculties in pursuit of their 'desires', so the state sought to fulfil its distinct 'desires': the accumulation of power and prestige.

I have argued elsewhere (Palan and Blair 1993) that the theory of the personality of the state produced the first coherent realist theory of International Relations,<sup>5</sup> a point made so cogently by one of its early proponents, Henrich Treitschke:

Treat the State as a person and the necessary and rational multiplicity of States follows....Just as in individual life the ego implies the existence of the non-ego, so it does in the State. The State is power, precisely in order to assert itself as against other equally independent powers. War and the administration of justice are the chief tasks of even the most barbaric States.

(Treitschke 1916:19)

Indeed, one could extrapolate the opposite: cease to treat the state as a person, or as a coherent unity, and the entire realist edifice crumbles. The metaphor of social closure, borrowed from the high-tech artefacts of the day, served, in other words, as the underlying model for an emerging theory of International Relations.

Since the realist theory was assembled from, and was an expression of, an organic metaphor, theories of human nature inspired a core of 'realist' conceptual constructs. The Cartesian problematic of body and soul—the two elementary concepts of Baroque psychology—found expression in the unity of 'territoriality' and 'reason of state' (Botero 1956)—the two elementary tools of realist thought. Territory is viewed as a form of concretisation of the social body. The organic cohesion of the 'sacred land' had therefore to be defended *at all cost*. Defence of the land was tantamount to the survival of the 'individual-state'. 'Security' therefore was beyond questioning. We find echoes of such ideas in today's International Relations theory. States, maintains Waltz as if it was a matter of fact, are imbued with 'survival instincts' (1979). Never mind that the notion of a 'sacred land' was a pagan relic of days when the gods resided in the hills and in the valleys and in things. Days when 'each tribe rejoiced in its peculiar deities, looking on the natives of another country who worshipped other deities as gentiles, natural foes, unclean beings' (Bryce 1968 [1864]: 90). Nationalist ideologies embrace them all. At the same time this higher body of state-person was infused with higher goals and desires, the so-called 'reason of state'. International Relations theorists like Morgenthau (1967) or Northedge (1976) made their pitch on the ground that individuals who occupy responsible posts 'in the state' are capable of distinguishing between their interests and the interests of the higher body. They are 'servants' of the state, and hence the abstraction called state, and not the social forces that make it up, is the 'unit of analysis' of International Relations.