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Futures 37 (2005) 521–546

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# Globalisation and the environment: the long-term effects of technology on the international division of labour and energy demand

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Available online 28 January 2005

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## Abstract

This paper examines the effect of the structural changes arising from the globalisation of production and innovation and from technological changes on the environment. Drawing on theories of international production from international business and innovation, we assess the impact of long-term technological change and changes in international production on the international division of labour and energy demand. We select two industrial sectors with different technological characteristics (the textile, clothing and footwear sector and the chemical sector). We examine the effects of the globalisation of production and of technological change on these two sectors on the level of industrial production and resource intensity in different regions and countries over the last 30 years. We speculate on the impact of globalisation of production and innovation in future pervasive technologies—information technology, biotechnology and nano-technology. The implications of these developments on industrial greenhouse gases emissions are assessed.

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## 1. Introduction

There is some agreement that we have entered into a new, more complex form of internationalisation—globalisation. Globalisation involves functional integration between internationally dispersed economic activities [14,18]. In this process, the operation of multinational corporations is the most important force creating international changes in the nature and location of economic activity as well as a new international division of labour. The strategies and operations of multinationals, and the resulting map of

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international production, trade and investment are much influenced by technological change. The effects of technology on the changing patterns of international production, trade and investment have important implications for the environment. Globalisation has also meant that there is an increasing recognition that the impact of apparently 'local' issues can be global. Climate change from global warming, caused by the industrial countries' huge use of fossil fuels, leading to increased concentration of greenhouse gases (CO<sub>2</sub>) is one such impact. Also, environmental policy and regulation at a national level have created differential cost structures and have become an important factor influencing international trade and investment [60].

The specific challenges faced by developed and less developed countries in the period of globalisation are different but interrelated. Less developed countries must institute processes that foster growth at the local level. Developed countries are better positioned to shape the way technologies progress and are used in developing completely new products and processes. These countries have the responsibility of technology leadership and the research capability to institute processes that foster environmentally sustainable growth. Despite the magnitude of the challenges, surprisingly, there have been few systematic attempts to examine the effect of the globalisation of production and innovation on the environment.

This paper examines the effects of technological change on the international division of labour and energy demand. In a previous paper [17], we made a first attempt at developing a qualitative method to assess the impact of technological change on the structure of production and its implications on the changes in the demand for energy up to the year 2050.<sup>1</sup> The analysis drew on insights of innovation literature such as long-wave theory [30]. We also used an industrial classification based on technological characteristics [52,62, see also 46], to identify the impact of three 'pervasive' technologies—information technology, biotechnology and nano-technology—on the production of a range of sectors and their consequent demand for energy. The findings of the study suggested that the assimilation and effective use of these three technologies would have a significant effect on future economic growth and energy demand (and therefore, under current energy-generating technologies, on CO<sub>2</sub> emissions) the magnitude of which will vary across countries.

This paper looks back over the last 30 years to examine the effects of technological change on the globalisation of production and innovation and the changes in energy demand (and, by implication, the level of CO<sub>2</sub> emissions). The paper presents quantitative evidence to support the existence of a relationship between technological change and the international division of labour and its consequent effect on the level of industrial production and resource intensity in different regions and countries. The paper is structured as follows. Section 2 emphasises the lack of integration of the literature on

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<sup>1</sup> We focused on the implications on changes in the demand for energy that sectors might make and thus, by implication, on the level of greenhouse gases emissions that would ensue if there were to be no matching changes in the means and technologies of energy supply, in what one might call a 'business-as-usual' scenario for economic development over the next 50 years. That is, we sought to investigate the extra contribution, or decrease, in greenhouse gases that long-term technological changes might cause, holding current patterns of energy supply constant.

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