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50 YEARS | TOGETHER for a sustainable future

Building ideas from data and practice

The intellectual history of UNIDO

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

50 YEARS | TOGETHER for a sustainable future

Those who cannot remember
the past are condemned to repeat it.

– George Santayana

FOREWORD

It is my great pleasure to celebrate this year a half century of UNIDO contributing to the eradication of poverty through industrial development. The Organization was founded In November 1966 to promote, assist and accelerate the industrialization of developing countries, with a special emphasis on manufacturing. During this spell, UNIDO has contributed greatly to building stable economic competitiveness, safeguarding the environment and creating shared prosperity in its Member States.

This juncture represents an ideal time to take stock of what has been achieved thus far, and what challenges lay ahead for industrial development. This 50th anniversary history outlines the intellectual contribution made by UNIDO to international development thinking during this period.

Some of these contributions have been UNIDO's own creation and have broken new ground: most notably the annual Industrial Statistics Handbooks, which have become a vital support for researchers, policymakers and statisticians in the field of industrialization. At other times, UNIDO had adapted established knowledge and practice to conditions on the ground to bolster the effect of our interventions.

As we can see herein, UNIDO has been resolute to move with the times, streamlining and adapting its services to the changing needs of the world's poorest, without ever compromising its core mandate and commitment.

For example, in the 1960s and 1970s, the Organization drove much of its activities towards technology transfer and increasing the economic self-sufficiency of countries through industrialization. In the 1980s, UNIDO placed a greater emphasis on promoting investment and export-led growth, and embraced challenges of sustainability and South-South cooperation. The 1990s brought a fresh approach to private sector empowerment and diversification of funding sources for the Organization, while more recently UNIDO devoted substantial resources to the problems of the new Millennium, chiefly youth unemployment, increasing inequality and climate change.

Though it faced many obstacles over the past five decades, industrial development has proven a resilient antidote to the fused challenges of poverty, inequality and associated social and environmental maladies. This is most vividly demonstrated through the return of industrial policies in several developed countries which opposed industrialization during the zenith of Washington Consensus thinking in the 1990s.

This endurance is also proven in the Organization's transition from promoting import substitution to a more free-market variant of industrial development, and in its greater emphasis on environmental and social sustainability since the early 1990s. This new departure was augmented in 2013, when UNIDO Member States adopted the Lima Declaration, endorsing inclusive and sustainable industrial development (ISID) for the implementation of their industrial development. ISID advocates that industrial output be underpinned by a robust social and environmental framework, ensuring that all people, whether they are men or women, young or old, urban or rural dwellers alike can reap the cross-dimensional benefits of greater industrial productivity.

The continuing relevance of industrialization to the wider multilateral objective of sustainable development was underlined at the 2015 Summit on Sustainable Development, at which United Nations Member States endorsed the Sustainable Development Goals (SDGs), among them Goal 9, "Build resilient infrastructure, promote inclusive and sustainable industrial development and foster innovation". This recognition of UNIDO's mandate of ISID is essential to the achievement of the whole SDG framework, considering the overarching applicability of ISID to every goal within the 2030 Agenda.

We remain committed to the implementation of this ambitious Agenda, and thus look forward to working with traditional and new partners—including UNIDO Member States, counterpart organizations in the United Nations system, development finance institutions, the private sector and academia—to tap into the full spectrum of resources and expertise necessary to leverage the potential benefits of ISID for all people.

Today, UNIDO is making the necessary strides, jointly with our development partners, to make ISID a reality in the 2030 era. We look forward to joining hands with all sectors and partners to achieve this, and to continue providing the cutting-edge research and thought leadership underpinning our technical cooperation and programmatic activities.

LI Yong
UNIDO Director General

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ACKNOWLEDGEMENTS

This 50th anniversary history of UNIDO is the result of intense research efforts into UNIDO's archives, early documents and history. What started as an exercise to detail UNIDO's contributions to development thinking became a way to rediscover the relevance of the organization and its successful course of navigation through world events, crises and internal changes. UNIDO's history sheds light on the evolution of development thinking over the past 50 years.

Analysing, selecting and putting into words so many years of history would not have been possible without the diligence and hard work of the lead author, Professor Raphael Kaplinsky, his research associates Luciana Fontes de Meira and Darren Gleeson, and the overall guidance and contribution of Ludovico Alcorta and, initially, Kazuki Kitaoka. Ilia Dohel supported the project by editing and proofreading the book.

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UNIDO's history is, above all, the history of the people who were in various ways connected to the organization in its 50 years of existence. Therefore, this work would not have been possible without the invaluable contributions and insightful comments by former and current UNIDO staff that were immensely beneficial to the compilation of this history. For this, we are indebted to: Kandeh K. Yumkella and Mauricio de María y Campos, former Directors General of UNIDO; Manuel Albaladejo; Robert Ballance; Peter Buckley; José de Caldas-Lima; Young Rin Cho; Michele Clara; Zdzislaw Fiejka; Helmut Forstner; Anubha Goyal; Nobuya Haraguchi; Sarwar Hobohm; Shinsuke Horiuchi; Anders Isaksson; Mithat Külür; Philippe Scholtès; Wilfried Luetkenhorst; Ralph Luken; Olga Memedovic; Sergio Miranda da Cruz; Pradeep Monga; Cassandra Pillay; Ghislain Robyn; Torben Roepstorff, Atchuk Tcheknavorian; Shyam Upadhyaya; Jebamalai Vinanchiarachi; and Tetsuo Yamada.

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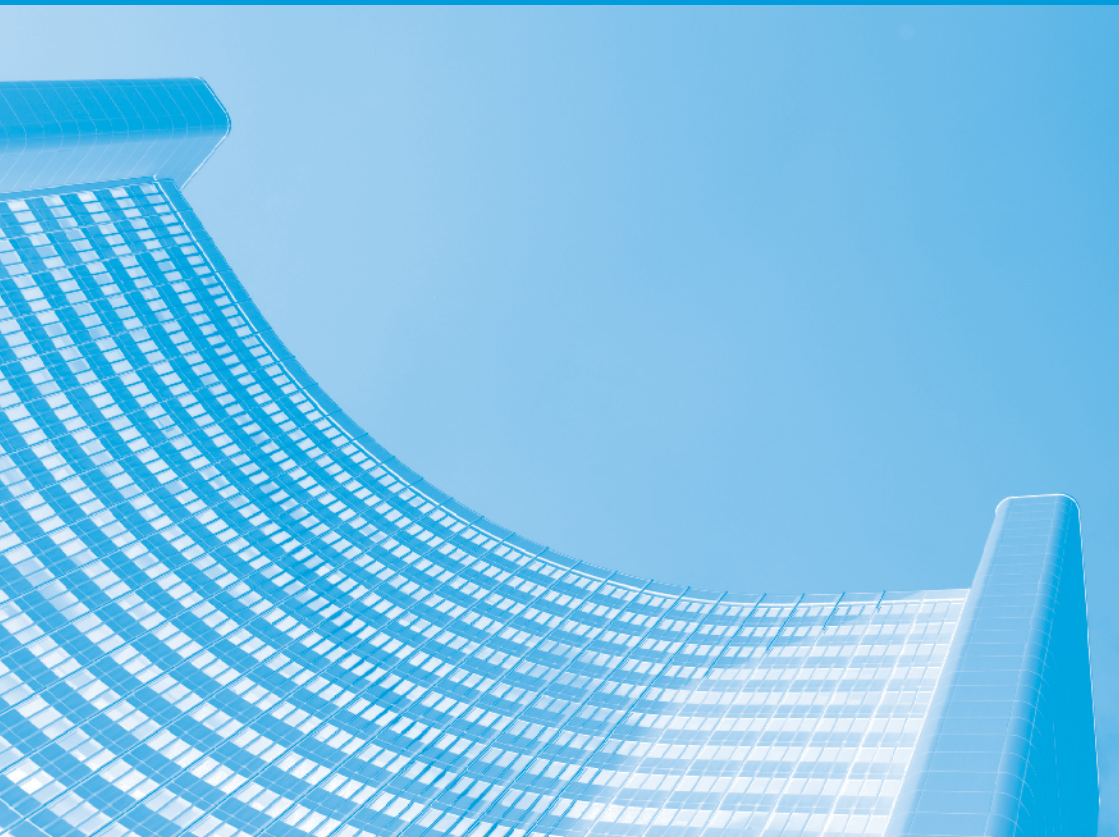
THE STORY



This book reviews UNIDO's intellectual history in the five decades since its establishment in 1966. Given UNIDO's practical remit in actively and practically supporting industrial development in developing economies, one could be forgiven for believing that the Organization has devoted lesser attention to theoretical knowledge. Yet, this publication identifies many areas where UNIDO's intellectual views and contributions have been significant, offering data and ideas to the organization itself as well as to researchers, policymakers, the private sector and civil society.

A selection of these ideas and contributions is provided in this book. The principle guiding this review is that "UNIDO's ideas" and "contribution to knowledge" comprise two sets of related outputs. The first is the raw material—the data—made available to the users of research to support their analyses of the nature, determinants and impact of industrial development. The second intellectual output is the contribution made to the analysis and theorizing of the nature, determinants and impacts of industrial development.

Twenty former employees of UNIDO were interviewed for this book. UNIDO's written output collected over the years was analysed, including some materials commissioned by UNIDO but never officially published. Due to the extensive time frame involved, the authors found it impossible to acknowledge all UNIDO's intellectual contributions, especially of the early years of its operation. Despite the gap in knowledge about the organization's early development, this review contains, wherever possible, examples of significant contributions to knowledge throughout the five decades since the establishment of the Organization.

This book consists of two parts. Part 1 sets the context. Its introductory section "Setting the scene" notes, perhaps surprisingly to some, that the developing world indeed achieved the very ambitious target set in the 1975 Lima Declaration – that it should account for 25 per cent of global manufacturing value added (MVA) by the year 2000. In fact, the actual figure reached 27 per cent (rising to 41 per cent in 2013). Yet most of this progress was concentrated in Asia (particularly in China); the shares of sub-Saharan Africa (just over 1 per cent in 2000) and Latin America (6 per cent in 2000) were small and static over the decades.

Chapter 1 describes the organization's institutional history. It recounts the early role played by the Industrial Development Centre at the UN in New York. Acting on the advice of ECOSOC's Committee on Industrial Development, the General Assembly decided to establish a subsidiary body within the UN system for the promotion of industrial development. This led to the creation of UNIDO as a special organ of the UN in 1966,

designed to promote industrial development in the developing world and headquartered in Vienna, Austria. UNIDO became a specialized agency in 1977.

During the 1990s, a decisive point was reached in UNIDO's development. The primacy given to the private sector in the development agenda, coupled with internal weaknesses within UNIDO, led to the withdrawal of three major donor countries from UNIDO – the USA, Canada and Australia. This threatened the very survival of the Organization. But an in-depth review of UNIDO's operations by a Danish-led enquiry in 1997 concluded that UNIDO had indeed been effective in its field operations and had an important role to play in supporting industrial development in the developing world. This led to the most recent phase of UNIDO's operations: supporting the progress made toward the achievement of many of the Millennium Development Goals set out in 2000. Most recently, revisiting the 1975 Lima Declaration, UNIDO has committed to support the Sustainable Development Goals, and, in particular, SDG9 to "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation". Despite all its ups and downs over the decades, UNIDO responds to this challenge in robust health.

Chapter 2 looks into ideas aiming to change the structure of global industrial development since 1950, and the theoretical and policy debates which accompanied these developments. A broad schematic periodization of the evolution of industrial structure, policy and theory is offered. The chapter identifies a number of overlapping and uneven phases of this evolution. The first phase was the precursor to UNIDO's establishment and the assistance it later provided to developing economies. This was the era of the "big push" and "linkage development". The period between the 1960s and the early 1980s was known as the era of import-substituting industrialization, favouring trade restrictions, which largely directed industrial investment and state-owned enterprises.

In early 1980s, the Washington Consensus period made export-oriented industrialization a priority. A significant expansion of export-oriented industrialization was the deepening of global integration by fracturing global value chains and growing trade in intermediates. This orientation to the industrial structure began during the 1970s; but it received considerable impetus by mid-1990s, including through the rapid growth of Chinese manufactured exports.

Rapid and diffusing industrial growth was associated with the development of significant negative externalities from the early 1990s, resulting in the growth of environmental problems, inequality and social and economic exclusion. Moreover, several global challenges emerged in the 1990s: most notably the changing nature of employment

and social inclusion, environmental sustainability and climate change, and the role of information and communication technologies. These factors gained significant currency in international political economy and thus merit some further elaboration.

There are numerous common themes which run through the discourse on industrial policies over the five-decade period. The first theme is the roles played by markets and governments. Here, there has been a shifting scene: with dirigiste policies to the fore in the 1960s and 1970s, and private sector-led policies dominant from the 1980s until the early 2000s. The second theme is the importance of macro stability as a precondition for sustained industrial growth. The third theme concerns the shifting perspectives on the nature of governments' selective industrial policies – should they target specific sectors, specific capabilities or particular firms? The fourth theme—about the nature and location of demand (local and foreign)—emerges as an important factor determining industrial growth. Finally, there has been a shift in thinking in which industrial policy is increasingly seen as a process rather than the production of prescriptive plans.

Part 2 of this book addresses a selection of areas around which UNIDO's thinking has evolved and where the Organization has made significant contributions to knowledge. All these contributions are related to the evolving structure of global industrial development and the theoretical and policy debates summarized in Chapter 2.

The first of these areas is the production of a robust and comprehensive database on industrial development. Without these data, much of the global analytical and policy debate on the nature, determinants and impacts of industrial development could not have been undertaken. This UNIDO database has grown in its reach over the decades, adjusting to changes in the global economy and new policy priorities such as the global SDGs adopted in 2015. A glimpse into UNIDO's plans for developing a new SDG database is also provided in this chapter, while previous work on information for investment promotion, particularly in Africa, is also outlined.

Chapter 4 discusses UNIDO's reaction and contribution to the debates of the 1950s and 1960s on the major drivers of industrial strategy. The decline in the relative price of commodities (observed by Hans Singer, the first head of research of the Industrial Development Centre in New York) was one of the key factors promoting industrial development. Rosenstein-Rodan's call for a "big push" was reflected in UNIDO with the adoption of the Lima Declaration in 1975 (and, arguably, the Lima Declaration of 2013 on inclusive and sustainable industrialization). Hirschman's call for unbalanced linkage-led growth has been reflected in much of UNIDO's core practical support for developing economies over the decades. These and other contributions to related topics (for

example on FDI in Chapter 5 and technology in Chapter 6) provided important inputs into the analysis of the nature, determinants and impacts of the import-substituting industrialization strategies which dominated in most developing economies until the late 1970s.

UNIDO's contributions to this analysis of the structural change can be traced back to the early stages of the academic debate in the 1960s and 1970s, and it continues to engage with this analytical discussion in the contemporary period. Four types of structural change are identified in Chapter 4. Each of them is reflected in UNIDO data contributions and in the analysis of structural trends, particularly the relationship between increased industrial productivity and economic growth and greater employment opportunities. The first category of structural change addressed in early UNIDO reports is the transition from an agrarian to an industrial economy at different levels of per capita income. The second is the change in the inter-sectoral composition of output at different levels of per capita income, with UNIDO making important contributions in the 1970s. In the very recent period, "normal" patterns of industrial development are analysed with a more detailed specification of sectors, and for many more countries and years than previously undertaken in the research community. The technology-intensity of changing industrial structure is also analysed using the taxonomy produced by UNIDO in 2003 (discussed in Chapter 6 in detail). The third set of structural change reflected in UNIDO contributions is intra-sectoral change, in particular the pattern and low rate of productivity growth in least developed economies. The final set of structural discussion addresses the changing technological intensity of developing economies' exports of manufactures, in which the least developed economies continue to be clustered in low-tech sectors. This chapter also outlines the growing accent on environmental and social sustainability within the broad sphere of structural change, with a review of the influence of UNIDO's mandate of inclusive and sustainable industrial development (ISID) on the elaboration of the 2030 Agenda for Sustainable Development.

Chapter 5 focuses on UNIDO's contribution to the analysis of investment in general and FDI in particular. Here UNIDO made a relatively early entry into the discussion in the UN system during the 1970s, leading to the establishment of investment promotion agencies in developing countries designed to facilitate appropriate FDI by providing them with detailed data on economic opportunities. Crucial to this early entry was the seminal "UNIDO Guidelines for Project Evaluation", co-authored by Amartya Sen, Partha Dasgupta and Steven Marglin in 1972, which played an important role in defining a framework for assessing the comparative merits of different investments. Keeping to its tradition of supporting on the ground investments UNIDO published in 1978 its "Manual for the Preparation of Industrial Feasibility Studies", which sold several

hundred thousand copies and became a landmark for the establishment of industrial enterprises in developing countries. More recently, since 2001, and particularly in 2011, UNIDO conducted several surveys of FDI in sub-Saharan Africa. The most recent survey interviewed over 7,000 firms in 19 African countries and helped create a unique and invaluable database for the research and policy community, as well as for the private sector. The most recent survey also drew on frontier research by collecting data on value chains and supply chain development.

The five decades since UNIDO's establishment have spanned a period of growing knowledge-intensity in the global economy. Technology, in its various forms, has become a key driver of industrial progress, particularly in allowing firms and economies to escape the competitive pressure which threatens to result in a "race to the bottom" and lead to reduced or stagnant income growth. UNIDO has made particularly significant contributions to both theory and knowledge in this regard. Chapter 6 focuses on technology and technology transfer issues, which dominated the policy discourse in the early decades of industrial development. But as investments in human capital grew in the developing world, the primary focus in the academic and policy community shifted from technology transfer and choice to technological development and capability-building. The Industrial Development Report of 2002-2003 was an influential study in addressing the contribution and measurement of capabilities to industrial development and economic growth. Its results and the categories of capabilities which it defined have been, and continue to be widely-used in the academic and policy fields. Likewise, a special focus is also devoted to the effect of technology on employment outlined in the 2013 and 2016 IDRs which elaborate extensively on that issue.

The significance of capabilities in industrial growth in general and particularly in the export-led growth strategies, which succeeded import substitution strategies after the mid-1980s, is discussed in Chapter 7 in the context of the growing role of global value chains in the world economy. UNIDO made an early entry into this debate by identifying and measuring the significant share of intermediates in global trade. Methodological contributions were made to the measurement of upgrading in global value chains, with the development of a taxonomy which takes account of market shares and unit product prices. In addition to these contributions to theory, a series of studies on specific value chains fed into UNIDO's internal discussions on global trends in fragmentation of production by providing a wealth of data on the nature and complexity of global value chains and the role they play in the determination of income and employment, both within and between economies. Chapter 7 also summarizes a UNIDO analysis of the drivers of linkage development from the commodities sectors in nine African economies. As in the case of UNIDO's analysis of investment and FDI (Chapter 5) and global value

chains (Chapter 7), UNIDO's core technical assistance programmes in the developing world ensured that it could make a significant progress in the analysis of industrial clusters in developing economies, particularly those involving SMEs. Chapter 8 documents the results of some of these UNIDO outputs, showing the extent to which they have aided employment and growth in a variety of contexts. These contexts include a survey of successful exporting industrial clusters in Asia and Latin America, and a survey of 25 industrial clusters in Africa. The discussion also casts light on the ways in which industrial clusters feed into employment growth and more equitable development outcomes, especially in relation to UNIDO's long-standing cooperation with developing countries on export processing zones (EPZs) and related business infrastructure. Industrial business parks and related potential for clustering are also discussed in light of their growing popularity since the 1990s.

As Chapter 2 notes, the 1990s witnessed the growth of the environmental dimension of industrial development, especially its sustainability aspect. Chapter 9 reports UNIDO's distinctive contributions to the analysis of these broad trends in two respects. First, although the relationship between industrial growth and the emission of greenhouse gases is widely reported by the research community, the detailed sectoral distribution of these emissions, and the changes which have occurred since 1990 are areas in which UNIDO's analysis adds to an understanding of these unfolding trends. Second, a particularly important contribution made by UNIDO was to provide detailed evidence of the potential for win-win outcomes between energy efficiency and economic profitability. This challenges the widely-held belief in many policy circles that mitigating climate change only involves costs to the consumer. UNIDO core energy concepts have also been influential in terms of codification of multilateral standards, especially ISO 50001. Chapter 9 describes in detail the extent and determinants of the adoption of green technologies in the agro-processing sectors in Nigeria and Kenya.

Chapter 10 closes the review of UNIDO's intellectual rational and contribution taken up in Part 2. It observes that there has been something of a revolution in modern thinking about business strategies and innovation management around the generation and use of knowledge. The emphasis has shifted in these domains from an obsession with plans and paper, to a consideration of the determinants of process as firms and economies are required to respond with increasing agility to changing competitive conditions. In the words of a key management theorist, strategy needs to be less of a "science" and more of an "art". A seminal report written for UNIDO by Rodrik in 2004 addresses these developments in corporate and innovation strategy to processes of industrial policy. He concludes that "*the analysis of industrial policy needs to focus not on the policy outcomes—which are inherently unknowable ex ante—but on getting the policy*

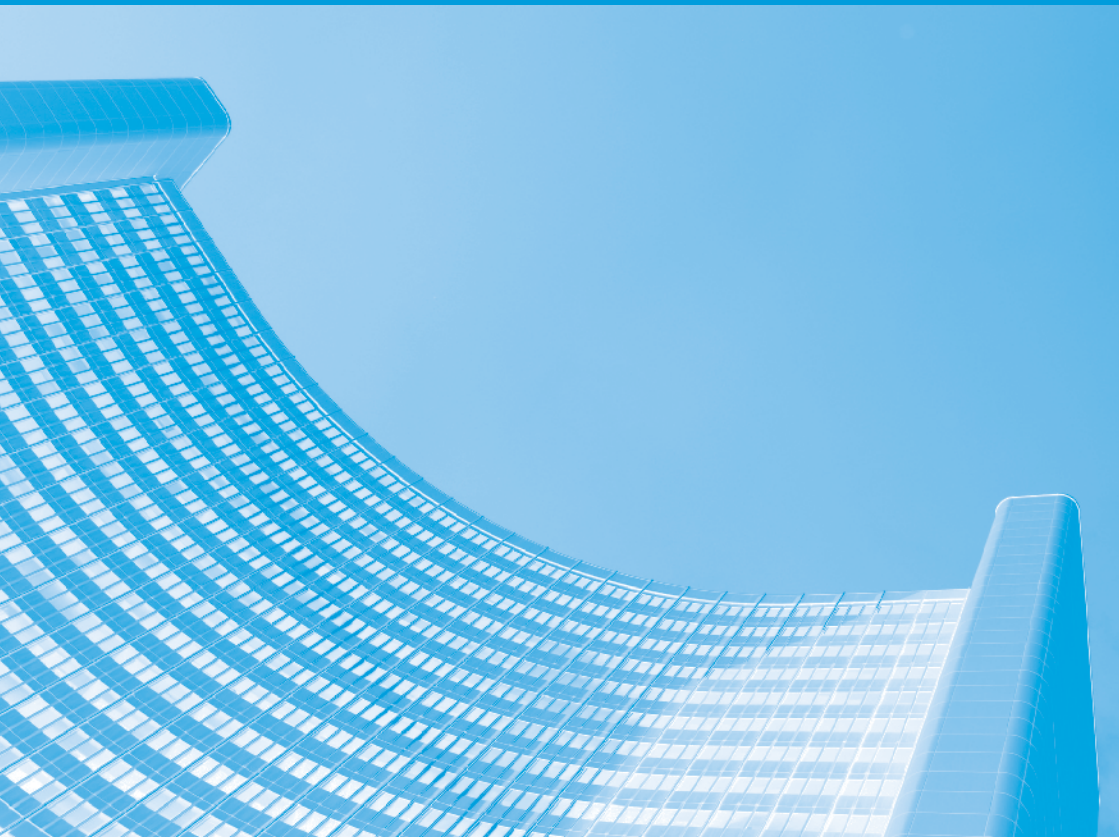
process right". These developments relate directly to UNIDO's prime contribution to industrial development: working with stakeholders across value chains to achieve dynamic capability building. This is evidenced in Chapter 10 by the example of two UNIDO programmes, one designed to foster capability-building across the economy at large, and the other to assist dynamic positioning within agro-based value chains. The lessons learned from UNIDO programmes on improving policy processes have not been adequately reflected in contributions to theory yet, but they form a knowledge base (similar to the knowledge base on industrial statistics) waiting to be mined.

Chapter 10 also charts the rise (and fall, and rise again) of industrial policy over the past half century, with a critical discussion of prominent perspectives and practices. UNIDO's Industrial Masterplans for Malaysia provide some historical and programmatic context in this regard. UNIDO's fusion of industrial development theory and practice are further delineated, with a final section exploring emerging issues for industrial policy.

Chapter 11, by way of conclusion, forecasts the future of industrial development, particularly in the context of the 2030 Agenda for Sustainable Development, which was adopted by the United Nations General Assembly in September 2015. The final chapter examines likely issues grouped into three categories – binding constraints; known uncertainties; and "quasi-black swans". Each of these developments pose threats to and offer opportunities for development and industrial progress – the balance between threat and opportunity will reflect the way that humankind and UNIDO respond to these challenges. From UNIDO's intellectual perspective, the challenge is to augment—to the fullest extent possible—the potential for positive outcomes, in particular those in line with the global commitment to the 2030 Agenda.

Part 1:

THE CONTEXT



SETTING THE SCENE

The Second General Conference of UNIDO in 1975 set the objective that the developing world should produce 25 per cent of global manufacturing output by 2000. The prospects for achieving this goal did not seem good at that time, since the share of developing economies in global MVA in 1960 was a mere 6.9 per cent, rising slowly to 7.3 per cent in 1970 and reaching 8.6 per cent in 1975. Yet, against all expectations (as opposed to wishful thinking), this target was not only met but exceeded. In 2000, the developing world accounted for 27.1 per cent of global MVA. Its share grew rapidly and reached 41.2 per cent in 2013.

How did this happen? And what were the reasons for the very uneven performance of different developing countries? In more than four decades, Sub-Sahara's share of global MVA has not changed. It rose slightly from a meagre 1.3 per cent in 1970 to 1.5 per cent in 1975, subsequently falling back to 1.1 per cent in 2000 and rising slightly to 1.3 per cent in 2013. Latin America tells a similar story, with its share in the four periods being 5.5, 6.4, 6 and 5.5 per cent respectively. In sharp contrast, China's share rose from 1.6 per cent in 1970, to 2 per cent in 1975, and then to 7.2 per cent in 2000 and 17.3 per cent in 2013.

The five decades since UNIDO was established have seen tumultuous changes in the policy environment promoting industrial development, with see-sawing debates between the virtues of state- and private-sector led growth and inward- and outward-focused industrialization. Who were the main drivers of industrial development and its changing geographical location observed above? And what role did ideas and information play in the capacity of different stakeholders to formulate and execute their visions for industrial progress? And, from the narrow perspective of UNIDO, what ideas were driving the Organization and what, if any, contribution did it make to the often highly-contested debate around industrialization and industrial policy?

In Part 2 of this book we analyse a selection of UNIDO's distinctive ideas supporting industrial growth and contributions to the pursuit of knowledge. Here we consider two types of intellectual endeavour – in the production of databases to support the analysis of industrial trends and policy impacts and in the domain of ideas.

One set of contextual drivers of UNIDO's intellectual ideas and contributions to knowledge is understood within the framework of UNIDO's institutional evolution. What were the Organization's terms of reference? How did they change over the decade? And how did this affect the nature of the questions which UNIDO addressed in its manifold activities? These issues are reflected in Chapter 1 on UNIDO's institutional development. Another set of contextual issues was the unfolding pattern of global industrial development and the ideas and debates which accompanied this unfolding process of growth. These issues are considered in Chapter 2.

Thus, before considering UNIDO's intellectual history since its formation in 1966, let us first describe the context in which the Organization's knowledge agenda evolved.

CHAPTER 1
UNIDO – AN INSTITUTION ON THE MOVE

1.1. The origins of UNIDO

The origins of the United Nations Industrial Development Organization (UNIDO) can be traced to a series of studies on a programme of rapid industrialization of developing countries(many of which had just achieved their independence), which the United Nations Secretariat carried out during the early 1950s at the request of the United Nations Economic and Social Council (ECOSOC). The latter had been stimulated by a resolution the United Nations General Assembly adopted at its sixth session in 1951.

That is not to imply, however, that industrialization was an uncontested concept within the development discourse of the immediate post-war era. Several prominent countries expressed their scepticism concerning the establishment of a multilateral organization to assist the efforts of "underdeveloped" (later "developing") countries to improve their industrial productivity, know-how and institutional architecture. During this period, the United Nations General Assembly had proposed the creation of such an office on several occasions, but each initiative was opposed by some countries.

Nonetheless, the aforementioned industrial studies culminated in a programme of work on industrialization and productivity prepared by the United Nations Secretary-General in 1956 and endorsed the next year by ECOSOC and the General Assembly. At that time, it was first suggested that a special body to deal with the problems of industrialization be established, whose political organs could relieve ECOSOC and the General Assembly of the detailed consideration of those questions and whose secretariat could carry out more substantive work than the existing Industry Section of the Bureau of Economic Affairs within the Secretariat.

During the next several years, the UN's involvement in questions of industrialization intensified, as did the search for more satisfactory organizational arrangements. The Industry Section of the Secretariat became a branch in 1959, and in 1962 it became the Industrial Development Centre, headed by a Commissioner for Industrial Development.

This concerted focus on industrialization took place amid broader development initiatives within the United Nations system. The bipolar international order which had emerged following the Second World War had pitted capitalist countries against countries favouring central planning, but had also inadvertently placed many newly independent states in between two hostile blocs (which itself led to the creation of the Non-Aligned Movement in 1961). These tensions had prompted President John F. Kennedy, in his address to the United Nations General Assembly, to call for a Development Decade to be established, to "lessen the gap between developed and underdeveloped countries, to speed up the processes of modernization, and to release the majority of mankind from poverty".

In January 1961, the General Assembly passed Resolution 1710 (XVI) establishing the First United Nations Development Decade. It called upon United Nations Member States and specialized agencies "to pursue policies designed to enable the less developed countries… to sell more of their products at stable and remunerative prices in expanding markets, and thus to finance increasingly their own economic development from their earnings of foreign exchange and domestic savings". Manufacturing also featured strongly, with a request to find "ways and means of finding and furthering effective solutions in the field of trade in manufactures". It was estimated that manufacturing output in developing countries would need to increase by at least 130 per cent over the following decade, if the headline goal of five-per cent growth in developing countries was to be achieved.

This momentum was built upon through several landmark developments within the United Nations system during the 1960s, including the 1963 Vienna Conference on Science and Technology for the Benefit of Less Developed Countries; the establishment of United Nations Conference on Trade and Development (UNCTAD) in 1964; and of United Nations Development Programme (UNDP) in 1965.

1.2. UNIDO as a special organ of the United Nations

During this flowering of optimism in international development, proposals for further institutionalizing industrial development-related issues within the UN were considered by various advisory groups and inter-organizational organs. In 1963, a ten-member Advisory Committee of Experts on the Industrial Development Activities of the United Nations System explicitly examined three alternative approaches: strengthening the existing Centre; creating a subsidiary organization within the UN; or instituting a new specialized agency.

Some industrialized countries believed that the United Nations' development programmes should be dealt with by a single organization. However, in 1965 a decision was finally reached. Acting on the advice of ECOSOC's Committee on Industrial Development, the General Assembly decided to establish a subsidiary body within the UN for the promotion of industrial development, as well as a 36-member Ad Hoc Committee on the United Nations Organization for Industrial Development (UNOID) (Res. 20899 (XX)). Based on the report of that Committee, the General Assembly on 17 November 1966 unanimously adopted Resolution 2152 (XXI) creating the United Nations Industrial Development Organization (UNIDO) as a special organ of the United Nations.

In January 1967, the Organization was formally established. A number of countries volunteered to host the new organization, but Vienna was chosen to host its Headquarters in a secret ballot by a large majority of votes. UNIDO's creation was intended to broaden the work of its predecessor, the Industrial Development Centre. In addition to acting as a forum for discussions, analytical functions and information dissemination, UNIDO became involved in technical cooperation activities. It was intended to act as the central coordinating body for industrialization within the United Nations system and to promote this at all levels – sub-national, national, regional and global, and across all industrial sectors.

1.3. Conversion into a specialized agency

The setting up of UNIDO as a special organ had been a compromise solution. The developing countries (the Group of 77) had in the first instance promoted the idea of a specialized agency with its own political decision-making governing bodies and autonomy in budgetary matters. The same position was advocated by an 18-member Group of High-level Experts on a Long-range Strategy of UNIDO, established by the Secretary-General in 1972 at the request of the General Assembly, and subsequently by the 27-member Ad Hoc Committee on a Long-range Strategy for UNIDO, appointed by the Industrial Development Board of UNIDO in 1973.

Following a series of crises and economic and political turbulence during the 1970s, the United Nations General Assembly adopted Resolution 3201 (S-VI) in 1974, proclaiming a new international economic order (NIEO). This represented an attempt at restructuring the existing international system along a more egalitarian line, especially with regard to several policy areas such as trade, financial, commodity, and debt-related issues.

The Resolution emphasized "equity, sovereign equality, interdependence, common interest and cooperation among all States, irrespective of their economic and social systems". Moreover, in terms of industrial development, the Resolution advocated a "Just and equitable relationship between the prices of raw materials, primary commodities, manufactured and semi-manufactured goods exported by developing countries and the prices of raw materials, primary commodities, manufactures, capital goods and equipment imported by them with the aim of bringing about sustained improvement in their unsatisfactory terms of trade and the expansion of the world economy", as well as technology transfer and promotion of upscaling capabilities in developing countries.

Ultimately, the NIEO was unsuccessful for a number of reasons, not least due to opposition from industrialized countries, but it did succeed in influencing subsequent events impacting industrial development, resulting most notably in the Lima Declaration of 1975.

In the context of General Assembly's adoption of the Declaration and Programme of Action on the Establishment of a New International Economic Order and of the Charter of Economic Rights and Duties of States, UNIDO's second General Conference, held in 1975 in Lima, Peru, adopted the Lima Declaration on Industrial Development and Cooperation. For the first time industrial development objectives were quantified

internationally. Thus, the Lima Target called for the developing countries to attain a 25-per cent share of world industrial production by the year 2000.[1]

Moreover, the Lima Declaration underlined that the promotion of industry should be part of a purposeful development strategy, rather than simply allowing market forces to dictate outcomes. Furthermore, it was emphasized that industrial cooperation should be the key mechanism for the achievement of industrial development, based on heightened cooperation between North and South, and also between developing countries (South-South cooperation) and sectorally between companies. The signatories also foresaw significant levels of multilateral and intra-UN cooperation, most notably in trade matters with UNCTAD and with the World Bank concerning public finance. Furthermore, the momentum gathered by the NIEO gave rise to an annual system of consultations between the developing and developed states (facilitated by UNIDO) to further dialogue and action concerning contentious issues linked to the NIEO, which would continue into the 1990s.

One of the most far-reaching consequences of the Lima Declaration for UNIDO, in institutional terms, was that as part of the institutional arrangements of the Lima Plan of Action, and with a view to assisting in the establishment of NIEO, it was recommended to the General Assembly that UNIDO be converted into a specialized agency.

To this end, it requested the Secretary-General, in consultation with the Executive Director of UNIDO, to draw up draft statutes for such an agency, to be adopted by the General Assembly after consideration by ECOSOC. The Secretary-General thereupon prepared a draft Constitution for UNIDO, which the General Assembly referred to as an intergovernmental committee of the whole to draw up a Constitution for UNIDO as a specialized agency. The revised draft that this Committee prepared was referred by the General Assembly to the plenipotentiary United Nations Conference on the Establishment of UNIDO as a specialized agency.

The Constitution of the United Nations Industrial Development Organization (hereafter referred to as "the Constitution") was adopted in Vienna on 8 April 1979 at the seventh plenary meeting of this Conference. In accordance with article 24 (1), it was open for signature at the Federal Ministry of Foreign Affairs of the Republic of Austria in Vienna from

1 The Lima Declaration was an early precursor of the Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs) as for the first time in the history of the UN a quantifiable global goal was set and ways of achieving it, or "means of implementation" in today's parlance, were suggested for countries to follow.

BOX 1.1: CONSTITUTION OF UNIDO

Article 1 of the Constitution defines the objectives of UNIDO as follows: "The primary objective of [UNIDO] shall be the promotion and acceleration of industrial development in developing countries [...]. The Organization shall also promote industrial development and co-operation on global, regional and national, as well as on sectoral levels."

In order to fulfil these objectives, the Constitution specifically calls on UNIDO to: (i) assist developing countries in the formulation of development, institutional, scientific and technological policies and programmes in the field of industrial development, (ii) analyse trends, disseminate information and coordinate activities in their industrial development, (iii) act as a forum for consultations and negotiations directed towards the industrialization of developing countries, and (iv) provide technical co-operation to developing countries for the implementation of their development plans for sustainable industrialization in their public and private sectors.

8 April 1979 until 7 October 1979, by all States referred to in sub-paragraph (a) of article 3; and after that date at the United Nations Headquarters in New York until its entry into force.

However, as the 1980s dawned UNIDO was confronted with fresh challenges. The oil crises of the mid- and late-1970s had brought considerable disruption to global economic growth, and some unsuccessful examples of import-substitution economics had caused industrial policy to fall out of favour in much of the industrialized world. What would later be termed the Washington Consensus (the phrase was coined in 1989 by John Williamson) emphasized an economic policy package encompassing ten policy prescriptions, including avoidance of large fiscal deficits, trade liberalization, privatization, liberalization of foreign direct investment and deregulation. This economic strategy was enthusiastically embraced by many heads of government during this period, especially in the USA and the UK.

The overall scepticism concerning industrial policy was, in some quarters, matched by a questioning of the value of multilateral development action altogether. In 1984, the Heritage Foundation in the United States published a study arguing that the NIEO had supplanted the original development mandate of the UN as expressed in the UN

Charter, and that each country individually should address its own national priorities. It also suggested that the role of the United Nations General Assembly should be reduced, and that the United States should consider withdrawing from the United Nations system altogether. In spite of more positive reports from other think tanks and commentators, the Reagan administration heeded several of the report's ideas, demonstrated by such actions as increased criticism of UN entities, a refusal to sign the UN Convention on the Laws of the Sea, and a US withdrawal from UNESCO.

Meanwhile, the objections and doubts of industrialized countries as to the necessity of a specialized agency for industrial development contributed to delaying the ratification process for UNIDO. Several successive steps of interrelated negotiations were therefore designed in part to ensure that the new organization would start up with a membership including all significant States and to facilitate such wide participation that procedural, financial, administrative and other rules and arrangements of the organization are generally acceptable. For this purpose the General Assembly, by resolutions adopted in 1982 and 1984, called for a series of formal consultations among prospective Member States, which eventually led to a general agreement that UNIDO's new Constitution should enter into force.

Pursuant to article 25, the Constitution entered into force when at least eighty States, having deposited instruments of ratification, acceptance or approval had notified the Secretary-General that they had agreed, after consultation among themselves, that the Constitution should enter into force. These formal requirements were fulfilled on 21 June 1985, and thereupon the first session of the new General Conference met between 12 and 17 August 1985 to start up the other constitutional organs.

Meanwhile, a relationship agreement was rapidly negotiated between the UN and UNIDO. With the approval of this relationship agreement by ECOSOC (resolution 1985/81), the General Conference of UNIDO (decision GC.1/Dec.38) and the General Assembly (A/RES/40/180) in December 1985, UNIDO finally became the sixteenth specialized agency of the United Nations on 17 December 1985. UNIDO established its Headquarters in Vienna, Austria, under the provisions of articles 57 and 63 of the Charter of the United Nations and article 18 of its Constitution.

In 1986 a landmark event in international development theory and practice took place with the General Assembly's adoption of Resolution 41/128, on the "Declaration on the right to development". This sought to promote a "…new international economic order based on sovereign equality, interdependence, mutual interest and co-operation among all States, as well as to encourage the observance and realization of

human rights". The Right to Development acknowledged that "All human rights and fundamental freedoms are indivisible and interdependent; equal attention and urgent consideration should be given to the implementation, promotion and protection of civil, political, economic, social and cultural rights". Though the concept became a contested one amongst legal experts, academics and development practitioners (specifically as to whether the Right to Development constituted a "right" as such, and whether such a right was legally enforceable in any case) it marked an important conceptual milestone through which UNIDO could advocate the value of its activities towards the achievement of sustainable development.

1.4. Crisis and reform during the 1990s

As with all international organizations of the time, the fall of the Berlin Wall in 1989 and the subsequent collapse of the bipolar international order of the Cold-War era posed considerable challenges for UNIDO. During the post-war era, UNIDO had been shaped by the prevailing west-east tensions. But following this reshaping of the international system, it had to contend with diminished resources and several new member states transitioning from central planning to free-market economies, most of whom would require assistance. Thus, a new category of countries entered the international relations lexicon: countries with economies in transition. Simultaneously, UNIDO could not neglect the pressing need to assist Africa's industrialization, which had been recognized through the adoption of resolutions in the General Assembly supporting the First and Second Industrial Decades for Africa (spanning 1980 to 1989 and 1993 to 2002, respectively).

Moreover, thinking within the United Nations system during that period had evolved considerably as to what should define priorities and action with regard to development policy. The Bruntland Commission (1987) had coined the term "Sustainable Development", declaring that "Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". It had also stipulated that population growth should be in harmony with the productive needs of the ecosystem, and that economic growth patterns should be geared towards the alleviation of poverty.

Building on these findings, the South Commission (established in 1990) aimed to reconcile the all-too-often competing objectives of the global North and South to pursue common solutions to international development challenges, overcome poverty

and satisfy basic human needs. To this end, it issued a series of recommendations for action, including:

- Establishing a regime for transfer of relevant technology from the North;
- Lending UNIDO's expertise towards increasing scientific infrastructure in the global South; and
- Establishing an international regime for energy, with the South receiving assistance in developing substitutes for fossil fuels and for adopting energy conservation methods.

This movement towards greater economic, environmental and social sustainability culminated in the United Nations Conference on Environment and Development in June 1992 in Rio de Janeiro (the "Earth Summit"). The Conference committed to several concrete outputs for environmental action, including:

- Agenda 21 — a comprehensive programme for global action in all areas of sustainable development;
- The Rio Declaration on Environment and Development – a series of principles defining the rights and responsibilities of Member States;
- The Statement of "Forest Principles" – a set of principles to underlie the sustainable management of forests worldwide;
- The United Nations Framework Convention on Climate Change – a framework for combating climate change by limiting average global temperature increases and the resulting climate change; and
- The Convention on Biological Diversity – a global agreement addressing all aspects of biological diversity: genetic resources, species and ecosystem.

UNIDO responded to these new multilateral priorities and augmented its activities in the environmental and social dimensions of development. It was particularly active in promoting resource efficiency, cleaner production and energy efficiency and establishing strong cooperation with organizations such as the Global Environment Facility, United Nations Environment Programme and International Standards Organization (see Chapter 9).

UNIDO also gained a strong standing in the international community for its expertise and technical assistance in the area of multilateral environmental agreements (MEAs). For example, in 1992 UNIDO became an implementing agency of the Montreal Protocol, which sought to protect the environment and human health through phasing-out of ozone depleting substances. As of 2012, the Organization has implemented over 1,200 Montreal Protocol projects in over 90 developing countries.

Likewise, UNIDO became one of the principal agencies for the implementation of the Stockholm Convention on Persistent Organic Pollutants (POPs), assisting developing countries and economies in transition to meet their commitments under the Convention. The Organization was also active in the implementation of the Minamata Convention, which aims to regulate emissions and releases of mercury and its compounds to protect human health and safeguard the environment.

Similarly, UNIDO bolstered its portfolio of activities and programmes relating to the social dimension of development, concentrating on pro-poor enterprise initiatives, capacity-building in developing countries, gender mainstreaming and women's empowerment to create more equitable outcomes from industrial development.

Despite growing recognition of UNIDO's technical cooperation capabilities several developments outside and inside the Organization began accumulating and eventually led to a crisis, which reached a breaking point in 1997 when UNIDO faced the risk of closure. Following the end of the Cold War and the triumph of the market economic system over the command economic system, some Member States felt that industrial development could be supported more effectively and efficiently by the private sector. As a result, Canada, the United States (UNIDO's largest donor at that time) and Australia withdrew from the Organization between 1993 and 1997, leading to a severe budgetary shortage and significant reduction in staff. Simultaneously, the continued slowdown in the economies of some major industrialized countries led to a decline multilateral development assistance, affecting the level of voluntary contributions to the Organization.

Such events, understandably, caused considerable turbulence in UNIDO, given the significant reduction to its regular budget and concomitant impact on organizational efficiency and effectiveness. Some influential development commentators even went as far as to suggest the closure of UNIDO. However, in 1996 Denmark initiated an in-depth assessment of the relevance of UNIDO to development for the consideration of its Member States. This report, released in May 1997, was to prove a turning point for the embattled Secretariat at that juncture.

The Danish assessment concluded that UNIDO was indeed still relevant, that its services were still in demand and that they met important developmental needs, particularly in the least developed countries. The report also observed that there would be no easy method of replicating UNIDO's contributions to development should the Organization cease to exist. The report concluded that "…no other organization has the same comprehensive experience, technical knowledge and multi-disciplinary expertise for continuing and

linking industrial technical cooperation services targeted at the policy and strategy level, the institutional framework and the enterprise level".

This rigorous assessment reassured donor countries of the positive impact of UNIDO and recommended that UNIDO continue to function as a specialized agency. But it also suggested a streamlining of administration costs and integration of activities, and that special attention be devoted to UNIDO's global convening role. The focus of discussions with Member States then turned to how best to maximize the efficiency and effectiveness of its operations and services.

UNIDO's Member States responded by adopting a Business Plan on the future role and functions of the Organization at the seventeenth session of UNIDO's Industrial Development Board in June 1997 (IDB.17/L.2). Activities laid out in the Business Plan were based on the perceived comparative advantages of UNIDO, including its work on SME development and on sustainable production, while avoiding overlap and duplication with other multilateral institutions, especially those in the United Nations system. Another key point was the integration of the Organization's activities into packages of services, rather than providing them on a stand-alone basis. Finally, several programmes, in particular its normative and analytical services, were minimized or discontinued to adjust UNIDO's activities to the new plan and the considerably tighter budgetary and personnel framework.

1.5. The post-reform period – from the MDGs to the SDGs

At the turn of the Millennium and in the context of global commitments to the Millennium Development Goals UNIDO responded by adjusting its strategic focus. Three thematic priorities were adopted through a Long-term Vision Statement (GC.11/8-IDB.30/23), namely "Poverty reduction through productive activities", "Trade capacity-building", and "Energy and Environment". These principles guided UNIDO's subsequent technical programmes. During this time, the number of staff and the Organization's budget were stabilized, and the volume of technical activities gradually increased while the normative and analytical functions remained marginal.

Meanwhile, the 1975 Lima target of developing countries contributing 25 per cent of global manufactured value added by 2000 was realised in 2005, primarily due to the rapid rise of China as an industrial powerhouse. At the same time, the share of Sub-

Saharan Africa in global industrial production remained below 1 per cent of world industrial output. These facts, along with the new global development agenda of the MDGs, led to a gradual shift in the focus of the Organization towards growth-oriented activities in countries with low levels of industrial activity, particularly in Africa, and support to cleaner production and environmental sustainability in emerging economies.

Following the financial crisis in 2008, and the resulting changes in the global economic landscape, the legitimacy of industrial policy in developing and developed countries alike was reiterated. Within this, in the context of the global economic downturn and declining public budgets in industrialized countries, the international aid architecture also shifted towards privatization, and an enhanced role for the private sector. At the same time, ongoing negotiations on climate change, and the outcome of the second summit on sustainable development in Rio de Janeiro in 2012, increased the sense of urgency among states of the need to tackle global development issues more systemically than through the traditional channels of international aid. In this context, the second Lima Declaration (GC.15/Res.1) was adopted at the 15th Session of the UNIDO General Conference 2013.

Responding to these global developments, and following the expiry of the MDGs in 2015, the United Nations General Assembly adopted a comprehensive new set of policies – the "2030 Agenda for Sustainable Development". It comprised an aspirational and comprehensive list of development objectives (the seventeen Sustainable Development Goals (SDGs) stretching to 2030.

SDG9 committed the global community to global community to "build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation". SDG9 laid out a series of specific goals to meet this objective (Box 1.2) and these will play the central role in guiding UNIDO's future activities as it enters its sixth decade as a vibrant and valuable member of the United Nations family.

BOX 1.2

SDG9 Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

- Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
- Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries
- Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets
- By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities
- Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending
- Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States
- Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities
- Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020

CHAPTER 2
INDUSTRIALIZATION THINKING IN TRANSITION

As shown in the previous chapter, UNIDO's evolution since its establishment in 1966 occurred in the context of a sea-change in the geographical global distribution of industrial activity. But it was not just that the share of the developing countries (and China in particular) grew over these five decades – so did the character of their industrial sectors and their insertion into the global division of labour in manufacturing. The past five decades witnessed surges of structural change (which will be discussed in Chapter 4) and, not surprisingly, this was accompanied by a ferment of discussion and disputation about the optimal path of industrial development and the roles which different stakeholders should play in this process.

Part 2 of this book looks into the intellectual debates that were taking place within the organization and assesses the extent to which UNIDO contributed to the heated exchanges about the nature, causes and impacts of industrialization. But this assessment cannot be made without an appreciation of the nature of these global debates. This Chapter is thus focused on this intellectual terrain of industrial development policy, distinguishing between a number of eras, starting with ideas about the big push and linkage development, and concluding with the recent focus on socially, economically and environmentally sustainable industrialization.

We proceed by periodizing this evolving intellectual agenda, conscious that many policy plans overlap these rough periods, and that there has inevitably been considerable variability in the performance and response of different regions in the developing world. The periods identified are as follows:

- Lessons drawn from industrial development in the high-income economies, pre-1940 (Section 2.1);
- The evolution of discussion about industrialization between 1940 and the establishment of UNIDO in 1967 (Section 2.2.);

- Decolonization and the diffusion of import substituting industrialization (ISI) – 1950s-1970s (Section 2.3);
- The demise of ISI and the onset of export-oriented industrialization (EOI) – the 1980s and beyond (Section 2.4);
- Industrialization in a globalizing world – the 1990s and beyond (Section 2.5); and
- Industrial challenges emerging in the contemporary world – post 2000 (Section 2.6).

This recounting of the intellectual history of industrialization and industrial policy concludes in Section 2.7 which addresses some meta-themes which run across these overlapping periods of industrial development.

2.1. The lessons from history — pre-1940

The industrial revolution marked a fundamental shift in the relationship between humankind and its environment and resulted in the improvement in human welfare. It culminated in growing productive capacity and rising incomes, a sharp rise in population and, ultimately, the era in which the human species has come to threaten the sustainability of the very physical environment, which underpinned this historically significant shift in economic activity. The primary driver of these momentous developments has been the growth of industry and the consequent shift in economic activity and population from the rural to the urban sector.

Adam Smith observed this process of structural change through the lens of the division of labour. He noted that the key to income growth lay in the growing division of labour which, he observed, was the wellspring of productivity growth. He argued that one of the key elements of productivity growth was the development of a specialized machine-building sector. Karl Marx provided the case-study material to show the critical role of this machine-building sector: once the tools of production were shifted from the human hand (which he termed "manufacture" (after the Latin word for hand, *manus*) to machines driven by water and steam power ("machinofacture"), human dexterity and physical prowess were no longer limits to productivity growth. Smith offered another key explanation for the growth of industry, that is that the division of labour was a function of the extent of the market; that is, the larger the market, the greater the potential for specialization, mechanization and productivity growth.

As the manufacturing sector unfolded more of its properties, the underpinning economic growth began unfolding too. It revealed the property to endlessly differentiate the goods it produces and to innovate, the property of economies of scale, the property of feeding its own growth through linkages between consumer and equipment goods and between general manufacturing and other sectors in the economy, as well as the property to generate positive externalities. Together these properties made the engine of growth of the manufacturing sector. Agriculture and mining did not possess this combination of properties.

Following the origins of the industrial revolution in England during the early 18th century, some European economies, and then North America, began to replicate this structural transformation and industrialize during the 18th and 19th centuries. This was followed by Japan after the 1870s.

As Ha-Joon Chang has convincingly shown, industrial development in all these economies—not just in England, but also in the "late developers"—did not happen by accident (Chang, 2002). At various stages and to varying degrees, in each of these economies, industrialization was promoted, and then facilitated, by a battery of policy interventions, including targeted restrictions on imports (through tariffs and outright bans on imports and exports), subsidies to exports, the delivery of infrastructure, direct and indirect financial support, subsidies to training, state-ownership, skill-promotion, the construction of pilot plants, the promotion of business organizations, etc.

2.2. The development of ideas: from 1940 until the establishment of UNIDO

Since the signature of the San Francisco Charter (also known as the UN Charter), there was a widespread conviction that it was crucial to promote economic and social development to achieve and maintain peace in the world, and a growing consensus that industry, and especially manufacturing, played a key role. On one hand, it was necessary to assist the recovery, development and re-industrialization of both the victor and the losing nations that had suffered much destruction throughout the war; on the other, it was recognized that poor or underdeveloped economies required government policies and support – especially on the financial and investment side and the participation of the private entrepreneurial sector to create jobs, increase productivity and follow eventually the paths of the rich countries. The concept of the

developing countries, and later the distinction between them and the less fortunate or industrially more backward least developed countries, came to the fore.

In the case of Europe and the developed economies, John Maynard Keynes and his school played a fundamental role stressing the significance of the aggregate demand and income policies, as well as the need to stimulate savings, investment and jobs in infrastructure in the productive sectors to get back to growth.

In the case of underdeveloped economies, it is important to remember that since the 1930s, and especially in the 1940s during the WWII, regional schools developed in Latin America, Asia and Europe, which insisted on the need to undertake paths and policies for industrial development based on import-substitution strategies. The economic impact of the 1930s crisis and of the war in Europe, and later on the USA and the Asia-Pacific fronts, resulting in scarcity and unavailability of many industrial consumer goods and intermediates and components, led to import substitution and fostered investments and government supportive policies in Latin America and Asia.

After the war, with the creation of the UN and the ensuing process of decolonization in Asia and Africa, development economists such as Arthur Lewis, Raúl Prebisch and Albert Hirschman would build upon planning theories and new policy ideas and doctrines that stressed the need for import-substitution policies in Latin American countries and the creation of fiscal and credit plans to promote industrial development with market protection of infant industries and promotion of forward and backward linkages. Around the same time Nicholas Kaldor was suggesting one of his "growth laws", which stated that there was a high correlation between living standards and the share of manufacturing activity.

In contrast, in India, Nehru's inclination for planning and "self-reliance" dominated industrial policy discussions and had little to do with LAC´s fascination for import substitution, external dependence and structuralism. Gunnar Myrdal himself with his "Asian Drama" was very influential on the UN, Regional Economic Commissions and academic circles to create a body of evidence and thought that promoted a series of studies geared towards rapid industrialization of developing countries.

As we have seen, one key factor explaining why economic growth increased in Europe, North America and Japan was the gains arising from specialization and mechanization. But this was not limited to industry and agriculture too reaped some of these benefits. But why was the potential offered by industrial development to growth so much greater than that arising in other sectors such as agriculture?

One important reason was the existence of "Engels Law": as incomes grow, consumers had an increasing preference for manufactures rather than primary commodities. That is, the long-term growth potential of industry was higher than that of agriculture, and so it was argued, manufactures would be less sensitive to price increases than would commodities. Added to this, it was observed that productivity growth was higher in industry than in the primary sectors, and that there was increasing scope for substituting synthetic materials for natural materials (for example, synthetic rubber, petrochemical based synthetic yarns for cotton and wool), further eroding the price of raw materials. Hence, as Hans Singer (who played an important role in the early development of UNIDO as its first research director) and Raul Prebisch (who, similarly, was a significant actor in the origin of UNCTAD) noted, the terms of trade between manufactures and commodities had shifted decisively in favour of manufactures. Namely, after many decades in which the prices of commodities had outstripped those of manufactures, this was no longer the case after the 1930s.

This combination of ideas, ranging from Smith, through Marx, and latterly through Singer and Prebisch permeated the rationale for industrial development from the late 1940s and, subsequently, through the 1950s and 1960s. The very rapid industrialization achieved by the Soviet Union, including through the promotion of its machinery-building sectors provided an impetus to the idea that structural transformation through the promotion of industry (and particular types of industry) was an achievable goal for the developing world. More than this, there were, as Gerschenkron came to argue, distinct advantages to being a latecomer, but that these advantages could only be achieved through the active intervention of what came to be called the "developmental state".

During the mid-1940s, Rosenstein-Rodan promoted the idea of the "big push", that is that industrial development would not arise from what he termed an "equilibrium" paths of growth, but from deliberate attempts to create "disequilibrium". He argued that the industrial development necessary to cope with excess rural population growth and boost living standards required economies of scale, not just within individual enterprises but across the entire economy. Further, the external economies inherent to production (such as the growth of supplier and user firms, and technological and skill spillovers) required the simultaneous development of complementary industries and infrastructure. Hence, argued Rosenstein-Rodan, industrial development required a big push, a concentrated attempt by governments to initiate and invigorate what would then become a self-sustaining process of structural transformation and growth.

A further ingredient in the cauldron of ideas which underlay the origin of UNIDO in 1966 was the idea of unbalanced growth promoted by Hirschman. This was somewhat at variance with Rosenstein-Rodan's idea of a big push, but nevertheless helped to rationalize attempts to deliberately promote industrial development. Hirschman argued that instead of a big push for balanced growth, the optimum policy set would be to deliberately promote unbalanced growth. This would induce supplier and user industries to develop and might be a particular advantage in developing economies with valuable natural resources. Hirschman also reinforced the importance of machinery in promoting productivity growth and presaged developments during the 1990s, including as will be shown below, the recognition of the role which downstream users and consumers play in innovation and industrial development.

2.3. Decolonization and the evolution of import-substituting industrial development – from 1950s until mid-1970s

The post-war period was characterized by a rapid process of decolonization, most notably in the Indian sub-continent, and then subsequently in Africa and other parts of the world. At the same time, many independent Latin American economies had seen a growth in their industrial sectors when they were cut off from Europe during the war and faced difficulties in obtaining manufactures from their traditional suppliers. These dynamics led to the promotion of import-substituting industrialization (ISI) as the core driver of industrial development. At the international level, the NIEO agenda was becoming vogue among developing countries, as was discussed in the previous chapter.

During the mid-1950s, India suffered from an acute balance of payments deficit, triggered in part by drought-induced crop failures. The Indian Government was also influenced by the Soviet Union, which had achieved substantial industrial progress through a combination of heavy restrictions on trade, extensive state ownership and a concentration of efforts on the production of capital goods. The confluence of these factors led to the development of what came to be called import-substituting industrialization. But India's industrial strategy from the mid-1950s was more than a strategy of controlling imports. It also involved extensive industrial licensing to guide investment into growth-inducing sectors and to avoid unproductive investments. Additionally, it actively promoted the state as a key owner in strategic industries.

Theoretically, the strategy consciously drew on "two-gap growth models" that is, that the key constraints to growth in the developing world were the savings gap and the foreign exchange gap. An additional distinctive feature of India's ISI model was the focus on small-scale enterprise, in which specific sectors were designated as preserving small enterprises. In turn, this focus on small-scale production reflected the commitment of Ghandi (and subsequently Nehru) to *swadeshi* (that is, local self-reliance and use of local knowledge and abilities) by using technologies which were appropriate to the economic and social circumstances of the poorest elements of society. This was the precursor to what subsequently came to be referred to as "appropriate technology" which received widespread global attention during the 1970s and 1980s.

In the early years, Indian industrial growth was impressive. The ISI model spread rapidly throughout the newly-decolonized world and Latin America, partly because of the demonstration effect of Soviet and Indian achievements, partly because of pressures from local industrialists to assist their growth, and partly because policymakers had been influenced by the need to promote industry as the lead sector for development. Trade restrictions—a combination of tariffs and quotas on imports—were more widely implemented outside India than industrial licensing, but many economies nevertheless promoted specific lead sectors through a combination of licensing, state ownership and incentives to local industry. Central planning and state ownership in the context of near autarchy were the central driver of Chinese industrial progress at that time, although the significance of these developments was not widely recognized for many years.

The lead sectors promoted in these ISI strategies were most often targeted to achieve dynamic comparative advantage, that is, building the technological capabilities and sectors that will become competitive in the future, rather than to reflect the existing economic advantages of particular economies. Hence, strategies to promote effective technology transfer, with and, often deliberately, without foreign direct investment, were core elements of the surge of ISI policies throughout most of the developing world. In many of these economies, industrial growth was rapid, and the manufacturing sector expanded rapidly both in terms of the value of output and the share of employment. Nevertheless, in absolute terms and by comparison with the industrialized world, manufacturing continued to be an "economic infant" – small and with a range of problems threatening its growth and survival.

2.4. The demise of ISI and the onset of export-oriented industrialization – the 1980s and beyond

The late 1960s and early 1970s witnessed the erosion of what has come to be called the "golden age" of the industrialized economies. Productivity growth began to slow and the oil crises of 1973-1974 and 1979 interrupted the rapid growth of these major economies. This resulted in a protracted period of stagflation — low growth rates coupled with rapid inflation. From the perspective of the high-income economies, therefore, there were political and economic pressures challenging the character and trajectory of the post-war economic growth. This was also a period of increasing criticism of the character of growth, both in relation to the social and economic appropriateness of industrial progress (in the "appropriate technology" movement) and through the widely-discussed Club of Rome report published in 1972 on the environmental limits to sustained and globalized industrialization.

At around the same time, there was also a ferment of criticism emerging with respect to the pattern of industrial development in the developing world, most notably in India. Two widely cited critiques of Indian industrialization (Bhagwati and Desai 1970) produced excoriating reviews of India's ISI performance. It argued that ISI had run out of steam. Not only were productivity rates falling (rising capital-output ratios) with a consequent waste of scarce investment, but ISI and failed to reduce overall import dependence. In other words, ISI had achieved neither of the two-gap objectives which had driven India's industrial policy – raising productive investment and reducing the foreign exchange constraint to growth. The critics argued that these failings were an inherent result of ISI policies, which had fostered corruption, diverted entrepreneurial energy into the search for permits and licenses, and had led to uncompetitive and undemanding economic environments (Krueger, 1973; Lal, 1984). The failure of ISI policies to save foreign exchange was not confined to India. Many Latin American and African economies ran into deep foreign debt problems in the late 1970s and throughout the 1980s. For most of the Latin American and African economies, the 1980s was a decade of "lost development".

But not all of the developing world was suffering from low growth during this period. Most notably, four Asian economies, the so-called Asian NICs (newly industrializing economies), were on a path not just towards rapid economic growth, and not just industrial growth, but also distinctively towards export-oriented industrial growth. Hong Kong, Korea, Singapore and Taiwan were "miracle economies", showing (it was argued) the limits of ISI *dirigiste* growth policies in which the state played an active role in guiding

the market. Their experience was used to force those policymakers in the developing world still committed to an inward focus to fundamentally alter their industrial and growth strategies. Aid to distressed indebted economies was offered on the strict condition that barriers to imports would be significantly reduced, that dirigiste policies designed to guide industrial development would be removed and that inward foreign investment would be promoted. This "neo-liberal" policy agenda mirrored political developments in the industrialized world inspired by prominent actors such as President Reagan and Prime Minister Thatcher promoting policies of deregulation and the marketization of the public sector.

The intellectual rationale for these policies—which came to be referred to as "the neo-liberal agenda", or "the Washington Consensus"—was frequently blurred and misinformed by both the proponents and opponents of the industrial policy. The Washington Consensus, which had emerged around a number of Washington-based institutions, including the IMF, World Bank and US Treasury Department, was a set of economic policy recommendations aimed at helping crisis-torn countries, mainly in Latin America, to recover from the economic and financial crisis of the 1980s. The approach involved macroeconomic stabilization, a more open trade and investment regime and welcoming market forces and the private sector in the domestic economy.

The Washington Consensus, which for many was the epitome of the neo-liberal agenda, was convincingly challenged on several fronts in that it wrongly ascribed the success of the East Asian "miracle economies" as resulting from the operation of uncircumscribed market forces. Careful analysis of Korea and Taiwan showed the strong hand of government in guiding and protecting enterprises from global competition and enabling domestic firms to successfully pursue dynamic comparative advantage (Amsden, 1989; Wade, 1990). Another line of critique was that the Washington Consensus had also misread history and had failed to recognize that virtually all of the then industrialized economies had benefited in earlier years from similar dirigiste measures (especially protection from imports) which aid-conditionality was prescribing in the developing world. The critique of the Washington Consensus reminded policymakers of Friedrich List's observation in 1885 that British attempts to force a free trade regime on continental Europe was an act of "kicking away the ladder", which it had previously used to develop its own industrial sector (Chang, 2002). Further, insofar as the Washington Consensus had recognized a role of industrial policy, this was effectively limited to trade policy, and in that, to the sweeping aside of import protection and the encouragement of outward-oriented industrialization.

In the face of this concerted critique, in the early 1990s the World Bank conceded that the success of the "miracle" economies had indeed resulted, in part, from government support. However, it argued that there was little evidence for beneficial sectorally-targeted state support, or support for micro-level structural change. Instead, it only conceded that state support had been productive in the provision of public goods such as skill development and infrastructure (Birdsal et al., 1993). On the other hand, the critique of the Washington Consensus had overemphasized the contribution of government-supported supply- and capability-augmenting policies in the newly industrializing economies, and failed to recognize the critical role played by global value chains in fostering and supporting the growth of export-oriented industrial growth (see Section 3.5).

Notwithstanding this debate in ascribing causality to the export success of these East Asian "miracle economies", it was incontrovertible and widely acknowledged that export-oriented industrial growth (EOI) had been a remarkable success. Its results were demonstrably superior to the ISI era, both in terms of the growth of economies and manufacturing value added (MVA), as well as in the generation of foreign exchange. For some, however, much of this successful EOI had been on the back of earlier phases of ISI. Moreover, unlike the 1950s and 1960s, the external environment during the 1980s and 1990s was one in which global buyers were actively searching for suppliers in low-income economies.

Before passing on to the intellectual agenda of the 1990s and beyond, it is important to note two features of post-war industrial development during this period which have growing relevance in the contemporary world. First, since the onset of the industrial revolution, industrial technology has become progressively more skill- and capital-intensive. Similarly, agricultural production systems have not only grown, but have also become labour-displacing. Hence, unemployment and the exclusion of unskilled labour had become structural features of all industrializing low-income economies, save for those few economies which had achieved rapid and sustained success in exporting manufactures. The consequence has been that the "informal sector" has grown in most of the developing world, with a significant proportion of labour forces working "below the statistical radar", including in unregulated micro enterprises in the manufacturing and related services sectors. For example, it is estimated that currently more than 90 per cent of India's labour force works in the informal sector, well beyond the capability of the modern industrial sector to absorb this surplus labour.

Second, both Alfred Marshal and Karl Marx, analyzing the character of the British industry in the 19th century, observed the significance of industrial clusters. They

comprised agglomerations of similar enterprises. These clusters were characterized by a pool of relevant skills, and benefited from the proximity of buyers and suppliers. From the mid-1980s and beyond, the significance of these clusters to industrial development was increasingly recognized, initially in Italy and other industrialized economies, and then, subsequently, in many developing economies. One of the determining characteristics of clusters, at least in their early stages of development, is that they are made up of locally-owned firms, predominantly small and often engaged in labour-intensive processes and activities. In many economies, clusters have become a significant source of MVA and industrial employment. From the industrial policy perspective, it is notable that experience has shown that clusters are often not easily created *ab initio* by policy intervention. On the other hand, clusters which have developed autonomously do benefit from appropriate support measures.

2.5. Industrialization in a globalizing world – the 1990s and beyond

The success of the East Asian miracle economies in exporting manufactures arose, in large part, from developments in the major importing economies in the north. This was a result of a significant reorientation in corporate strategies, beginning in Japan in the 1970s and then spreading rapidly to other industrialized economies after the early 1980s. Historically, "optimal" corporate strategies had been designed to reduce the heavy transaction costs in working with suppliers and to avoid being subject to dependence on suppliers in whom they often had little trust. Consequently, the dominant mode of corporate organization was for lead firms to internalize the production of many of their components and other services. This was one of the major factors driving the global extension of transnational corporation.

However, new forms of corporate organization were developed in Japan from the late 1970s ("lean production") which allowed firms to outsource the provision of many inputs which they had previously produced themselves. Based on this, the idea grew that firms should specialize in their core competences – those activities where they had distinctive capabilities and which were hard to copy. The inputs not meeting these criteria were outsourced to suppliers. At first these suppliers were geographically proximate to the lead firms. But increasingly they concentrated in low-cost producing economies: initially in the newly industrialized Asian economies (Hong Kong, South Korea, Singapore and Taiwan) and then, increasingly, (after the late 1980s) in China. This fracturing and globalization of the production chain is referred to as the "global

value chain" (GVC). GVCs spread rapidly across many sectors of economic activity and this had six important consequences for the global dispersion of industry and for industrial policy.

First, global trade increasingly to made use of intermediate products. By 2014 more than two-thirds of global trade occurred through the medium of GVCs. One of the consequences of this was that the value of global trade was significantly overestimated (by around 28 percent, according to the OECD and the WTO) since the value of components was counted twice (and sometimes more than twice), as exports of intermediates (for example the screen of a mobile phone exported from Korea to China) and in the final product (the screen as part of the mobile phone exported from China to the world). While the share of exports in global GDP in 2000 was similar to that in 1900, the character of global trade in the current era (trade in intermediates) was structurally different to that of the late 19th century. Economic historians characterize this structural shift in the composition of trade as the contrast between internationalization and globalization.

Second, since firms and economies were increasingly exporting intermediates rather than final products, the challenge to achieve competitiveness shifted in part from the development of sectors (for example, mobile phones) to capabilities (screens, semiconductors, assembly). How to measure this shift in the composition of trade is currently being addressed by the WTO, the OECD, the World Bank and national statistical offices throughout the world. Similarly, the corporate sector is engaged in the search to specialize, develop and protect distinctive core competences, rather than to internalize the supply of inputs in the production of final products. And governments are seeking to help their economies to specialize in cross-sector competences (bio-engineering, nanotechnology and software), as much as traditional sectors (for example, automobiles).

Third, as industrial firms have concentrated on core competences and fractured their value chains, many activities which were previously within the industrial sector — such as design, branding and marketing — have been outsourced to specialized suppliers. These knowledge-intensive activities, incorporated in "manufacturing", are formally classified as "services". This has not only contributed to a decline in the value of manufacturing production and employment in many high-income economies, but also created a challenge for industrial policy, which necessarily must address not just the development of manufacturing, but also of manufacturing-related services.

Fourth, in many cases, manufactured exports from low-income economies were produced in a variety of cluster zones (variously referred to as "export processing zones" and "special economic zones"), which benefit from incentives specifically designed to promote exports. At one extreme, value added in these zones remained thin and the zones contributed little to domestic value added, despite high levels of gross exports. In other economies, such as South Korea and China, export zones systematically developed linkages to the local economy, a reflection of Hirschman's observations in the 1960s of the potential provided by unbalanced and linkage-driven industrialization.

A fifth major development in the globalized economy has been the massive and historically unprecedented shift of global manufacturing from the north to the south. The nature and significance of this shift has been substantial, allowing the developing world to achieve the objective of the Lima Declaration of 1975, which set a target for the developing economies to account for 25 per cent of MVA by 2000 (Chapter 1). However, this global dispersion of MVA has two significant characteristics which determine the spread of gains from global industrial production. First, the overwhelming share of southern manufacturing production and exports has been contributed by China; much of these Chinese "exports" have included intermediate products sourced from the Asian region and assembled into final products and exported from China. Africa's share of global MVA has remained low and stagnant (1.5 per cent of global MVA in 1975 and 1.3 per cent in 2013), and Latin America's share has changed little (5.4 per cent in 1975 and 5.5 per cent in 2013). Second, in the early years of UNIDO's development, manufacturing had been concentrated in the north (mostly in developed countries) and exchanged for commodities sourced from the south (mostly from developing countries); as Section 2.2 shows, this had resulted in a sustained increase in the terms of trade of manufactures compared to commodities. But in the current era many low-value and easily replicable activities within manufacturing are located in low-wage southern economies. Consequently, we have witnessed the development of declining terms of trade *within manufacturing* (rather than between manufacturing and commodities) of low-value added manufactures produced in the south compared to high-value added manufactures produced in the OECD economies (and now also in China). Additionally, the rapid growth in demand for commodities from China after 2000 led to a shift in the manufactures-commodities terms of trade (in favour of commodities) between 2003 and 2013.

A final consequence of industrial growth in the modern globalizing economy has been pervasive de-industrialization in the historically industrially-dominant north. Initially, during the 1990s and early 2000s this involved the displacement of low-tech and low-

skilled sectors (such as footwear and apparel). But as industrial capabilities grew in the south, northern de-industrialization has spread to other more complex sectors such as metal components, semiconductors and services feeding into industry (for example, software). The displacement of industrial production and associated employment has contributed to growing trade deficits in some northern economies (notably the UK) and bilateral trade deficits in others (for example between the US and China). However, this has not spread throughout all northern economies: some, including Germany, have managed to maintain their specializations in the industrial sector.

But this phenomenon has also had significant political impacts as de-industrialization and the displacement of employment in northern rustbelt regions has led to a growing call for protectionism and a reaction against globalization.

2.6. Challenges confronting the industrial sector – post-2000

Although globalization and the extension of GVCs were major factors driving the geography and nature of industry after the late 1980s, they were not the only factors which had a bearing on industrialization paths and prospects. Four additional drivers can be identified, some of which are inter-related and some are, to some extent, outcomes of the extension of globalization and GVCs. These are the prevalence of exclusion, unemployment and informality in industry; the environmental character and impact of industry; and the opportunities and threats posed by radical new technologies

2.6.1. Inclusion, unemployment and informality

Underemployment and unemployment have been consistent challenges confronting the development policy in the five decades since UNIDO was established. In the early years, there was a belief that the industrial sector would absorb the surplus labour displaced from agriculture. But, as we observed in Section 2.4, from the early 1970s it became obvious that the capacity of the formal manufacturing sector to absorb the labour displaced from agriculture (let alone to take advantage of the potential offered by underemployment in other sectors of the economy) was severely limited. The exceptions were economies such as Hong Kong, Korea, Singapore and Taiwan, and then latterly China, who had achieved remarkable growth in manufactured exports.

In part, the structural nature of unemployment is a direct consequence of patterns of labour-saving technological change (Chapter 7). But it also arises from the pattern of income distribution, since the demand profiles of high-income consumers tend to involve relatively capital-intensive production processes (compare the labour content embodied in luxury yachts with that required to produce footwear and apparel). Hence the trajectory of income and wealth distribution—which in many countries has grown more unequal since the 1980s—is one of the factors which limited the industrial sector's capacity to provide gainful employment. But at the same time, the trajectory of the global industrial sector has been one of the causes of inequality. This is because the capacity of those possessing valuable capabilities (such as skills and intellectual property) has allowed them to valorize these "rents" over a larger global population, whilst at the same time those without special attributes (such as unskilled labour) have had to compete with a much larger global supply of these resources.

Complementary to these structural features of unemployment and income inequality has been the biased pattern of innovation in the global economy. The primary drivers of global innovation have been factor prices (much of innovation has been located in high-wage economies and led to the development of capital-intensive technologies), skewed patterns of income distribution (leading to innovation in products meeting the needs of high income consumers rather than poor populations with very limited purchasing power), and high-quality infrastructure (limiting the spread of production and consumption in marginalized communities).

The net outcome of these related incomes is that the extension of global industrial production has occurred in a context of widespread social exclusion. Although this has predominantly been a phenomenon experienced in low-income southern economies, in recent years social exclusion has also become a major problem in some northern economies, in part through the displacement of labour resulting from de-industrialization.

2.6.2. The environment and climate change

Global warming, climate change and climate variability are indisputable facts that have received increasing priority in multilateral politics over the past two decades. They have begun to have a major and predominantly adverse impact on human welfare; and the severity of these impacts is almost certainly likely to increase in the future. One of the primary causes of these environmental developments is the carbon-intensity of the energy utilized in industrial production, in final products and in the infrastructure required by global production systems.

The decarbonization of the industrial sector – both in terms of production processes and the products which are used – has thus become a major challenge confronting national governments and regulatory systems globally. In recent decades the global community has addressed this agenda through a series of binding international agreements, beginning with the Rio Conventions of 1992 tackling biological diversity, desertification and climate change; encompassing cleaner production via the Montreal Protocol, Stockholm Convention and Minamata Convention; decarbonization of the environment through the Kyoto Protocol; and latterly the Paris Agreement, which seeks to reduce increases in average global temperatures as measured against pre-industrial levels.

From the perspective of the industrial sector, four sets of responses are required. First, greater energy efficiency is needed in production processes at the level of industrial plants and firms. This is often referred to as "decarbonization" or "dematerialization" and involves changes both in machinery and in the organization of production aimed at reducing energy consumption in general or per unit. Second, and related, decarbonization needs to occur throughout the value chain and not just in individual plants and firms. For example, reducing the energy intensity of production in an economy by shifting energy-consuming processes to other economies does little to address the problem of carbon-displacement, so that the relevant metric is thus not the ratio of energy to GDP in an economy, but of energy to consumption. This also requires actions to reduce the energy intensity needed to produce a final product.

Third, greater energy efficiency in the industrial system cannot be achieved by actions taken at the level of individual plants and firms alone. It requires coordinated response throughout the chain of production. For example, attempts to improve energy efficiency in individual sub-processes of a food chain, such as maize grinding, are dwarfed by energy losses in the energy-inefficient logistical transfer of agricultural inputs, ploughing and harvesting of maize, the delivery of maize to grinders, delivery of flour to the retail sector and onwards to the final consumer, and in the cooking of the flour.

And, fourth, enhancing energy efficiency in and through the industrial sector does not only pose a threat and a cost to producers. It also provides a major opportunity for production and value accretion. Some economies such as Germany and Denmark, and increasingly China and India, have come to see and grasp the potential in the production of green technologies, such as solar and wind-power systems.

Although decarbonization is important in meeting the threats of climate change, this is not the only environmental challenge and opportunity confronting the industrial sector. In many cases, water availability and water quality assumes as much importance as climate change and climate variability in affecting the livelihoods and quality of life of populations. The harmful impact of effluents, organic and inorganic, stemming from the industrial sector, has become another factor which poses severe environmental problems to humans, as well as to other forms of animal and vegetable life. Feeding into the exclusion from the fruits of growth observed above, poor populations tend to be particularly adversely affected by these harmful environmental developments.

2.6.3. The potential offered by new technologies

One of the paradoxes of economic growth in the five decades since UNIDO was formed was that after the mid-1970s, productivity growth slowed despite the development and diffusion of a significant productivity-enhancing family of technologies – information and communication technologies (ICT). Whatever the cause of this slowdown in economic and industrial productivity growth, the economic, social and even the political impact of ICT technologies cannot be underestimated.

From the perspective of the developing world, ICTs played a major role in facilitating the logistics and communication flows which allowed them to participate in GVCs. The fracturing of value chains into myriad sub-processes (leading, as we have seen, to an expansion in the trade of intermediates and traded services) required low-cost, reliable and rapid communication technology. The separation of design and marketing from the physical transformation of materials could only be managed effectively through the digitization of the knowledge component in the value chain, and in the controls of machinery.

ICTs, and more precisely digitalization, have not only opened the possibility for the development of accurate sensors, controls and communications between machines across the world but, together with progress in new materials, advances in photonics, 3D-printing, nanotechnology and artificial intelligence, are making it possible to move manufacturing production into a completely new level. Manufacturing is moving into a “new, or fourth industrial revolution” where cyber-physical systems connected in any location and across any stage of value chains will be able to self-control and self-regulate themselves and produce goods in “smart factories” much more responsively and efficiently than ever before.

However, ICT has not been the only radical technology which has diffused widely in recent decades, and nor did it only affect the exports of manufactures. The application of ICTs also improved the capacity of the industrial sector to meet domestic needs. For example, mobile telephony has transformed the quality of financial intermediation in some economies (such as the rapid diffusion of M-Pesa in Kenya) and has wide-ranging productivity-enhancing impacts in agriculture, especially in improving access of farmers to knowledge of final markets and prices. When allied to advances in solar photovoltaics and wind-power, a combination of technologies has not only reduced the costs of energy transmission and been carbon-displacing, but has also facilitated small-scale and dispersed off-grid industrial production.

2.7. Meta-themes spanning different epochs of industrial development in the post-WWII era.

In previous sections we periodized the pattern and intellectual rationale for industrial development in the post-WWII industrial development into a number of rough timeframes, conscious that they overlap and were not uniformly experienced through the global economy. Despite the diversity of global experience, this periodization exemplifies the dominant discourse and events that influenced the character of industrial policy in the five decades since the establishment of UNIDO.

It is possible to draw a number of themes from this evolving agenda which, explicitly and implicitly, surfaced as persistent and important issues throughout this long time-frame, and which are of considerable relevance in enabling developing economies to meet the challenges set out in Goal 9 of the SDGs (“Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation”). These are the roles played by states and markets; the significance of industrial-growth supporting macro policies; the targeting of sectors, markets and capabilities; the role played by final market and buyers in industrial growth; and the recognition of the industrial policy as a process rather than a master plan.

2.7.1. States, markets and industrial growth

The role played by markets and states in industrialization has been a source of major intellectual and policy debate.

The *dirigiste* developmental states favoured by the proponents of ISI were the order of the day in most developing economies during the 1950s, 1960s and 1970s. These explicitly sought to override the market in the allocation of resources. The rationale was that markets were poorly developed and functioned imperfectly, that local capital was either weak on non-existent, that there were a series of externalities (for example, related to skill development) which led to under-investment in market-led growth, and that (as Rosenstein Rodan argued in his idea of the "big push"), in the early stages of industrialization, a coordinated investment programme was necessary to produce wide scale economies. But this active statist programme of industrialization ran into multiple problems. Not all states were progressive and/or capable of managing this agenda effectively; the plethora of regulations diverted entrepreneurial attention from managing and expanding their productive activities; and the permit-intensive environment promoted a culture of corruption.

By contrast, the withdrawal of the state from explicitly assisting and actively promoting industrial development had its own problems. Although it freed entrepreneurial energy from "rent-seeking" behaviour (the search for permits and support), weak capabilities and poorly functioning markets were a reality in much of the developing world. The industrial outcome of the implementation of the Washington Consensus policy agenda was one of significant de-industrialization in some countries and a continuing dependence on static comparative advantage, exposing producing economies to declining terms of trade, including within the manufacturing sector.

There has been something of a counter-revolution against the Washington Consensus in recent years, fostered in part by the fact that de-industrialization is not just a phenomenon experienced by developing countries, but by the industrialized economies as well. Moreover, it is abundantly clear that China, with its remarkable level of industrial development in recent years, shows how state intervention in the market (and in many cases, state ownership) played a critical role in its rapid industrial growth. Similarly, there is growing recognition that the state played a critical role in the development of the Internet, key ITC technologies (for example, virtually all core elements of the iPhone) and other emerging technologies in the US and other industrialized economies (Mazzucato, 2011).

Consequently, industrial policy is back on the policy agenda in both high- and low-income economies. But it is an evolving policy agenda which seeks to avoid both the excessive statism of the ISI era and the follies of extreme marketization. It is also a policy agenda which recognizes the importance of context – one-size-fits-all policies are clearly dysfunctional.

2.7.2. Macroeconomic policies and industrial growth

As in the case of the roles played by states and markets in industrial development, there has been an ongoing debate on the optimum macro policies required to promote industrial development, particularly rapid industrial development. Hirschman's influential contribution to the policy debate in the 1960s argued that macroeconomic imbalances, such as inflation and balance of payments deficits, were an inevitable, and indeed in some senses a desirable, outcome of disequilibrium, linkage-led industrial development. However, in those developing economies (particularly in Latin America and Africa) where inflation escalated rapidly during the 1970s and 1980s, the incentives to invest in productive activities was significantly eroded; moreover, balance of payments deficits limited access to scarce inputs. In this respect, the Washington Consensus clearly had a point.

On the other hand, an obsessive focus on macroeconomic stability, particularly on price and exchange rate stability and limiting governments' abilities to deficit finance infrastructure, as well as on supporting innovation, did not foster new technologies and industrial development.

Hence, there is widespread recognition that whilst macroeconomic policy plays a critical role in setting the parameters for industrialization, equilibrium and stability, and disequilibrium and turmoil, may play negative and positive roles, and that these will change over time and between economies. It is a difficult ship to steer for policymakers, not least because different interest groups in society are impacted in various ways by alternative macroeconomic growth environments.

Developing a macroeconomic environment which fosters industrialization is not just a question of controlling prices and fiscal deficits. It also requires predictable property rights, security of livelihoods and operations and a sustainable infrastructure which is supportive of industrial development. In former years, in addition to energy and water, a primary infrastructural requirement was one which smoothly and efficiently supported the physical transfer of materials. In the era of ICTs and fractured GVCs, a key infrastructural requirement is access to low-cost, high-bandwidth and distributed access to the Internet.

2.7.3. Targeting sectors and capabilities

The extent to which industrial development should reflect existing sectors of comparative advantage or areas of dynamic comparative advantage is a theme which pervades the discussion of industrial policy through the decades. There are extreme views. The pure market-led approach to industrial development allows the market alone to determine the existing and changing structure of an economy. This often leads to sclerotic economic structures confronting intense competition as they compete in a "race to the bottom". Implicitly or explicitly, almost all economies have rejected this extreme hands-off approach to the determinants of economic structure. But to what extent and how the state might intervene to support existing economic sectors or promote the development of new sectors of industrial activity has been, and remains a contentious policy issue.

There are many cases in which governments failed abysmally in the "picking of winners", whether they sought to achieve this through industrial licensing, preferential access to key inputs and finance, targeted support for innovation and skill development or other policy measures. On the other hand, as noted in Section 2.7.1 above, there is overwhelming evidence that in virtually all successfully industrializing economies, some measure of targeted state support has been a critical component of growth.

In recent years, the challenge of targeting has become more complex, particularly in economies which are pursuing a growth path seeking integration into the global economy. As observed earlier, the advance of GVCs has meant that increasingly, firms and economies are specializing in certain capabilities which are generic to a range of sectors (for example, assembly skills, software and nanotechnology), rather than to specific sectors (for example, apparel, textiles and footwear). This poses great challenges for skill- and capability-building as well as for innovation systems. The variability in economic structure globally means that balancing the combination of incentives designed to both support specific sectors and generic capabilities—without dulling the contribution which the market can make to efficient resource allocation—poses new challenges to industrial policy.

2.7.4. The role of demand in industrial growth

For most of the five decades since UNIDO was established, industrial policy was focused on the development of capacity. It largely represented a supply-push approach to industrialization, including with respect to the capacity to participate actively in global markets (i.e. invest in industrial capacity and skills, and success will

automatically follow in export markets). However, in the past two decades, the more active role of users in leading producers challenged this supply-oriented approach.

The first has been the character of GVCs. The critical role in GVCs has been played by lead-buyers. Sometimes these lead buyers are transnational companies (TNCs) producing goods on a global scale and actively seeking intermediate inputs from low-cost and reliable suppliers, delivered in predictable quantities and times. In other cases, the lead-buyers are final retailers such as Walmart and Tesco and global brand names such as Nike and Adidas. They, too, seek reliable and low-cost suppliers on a global scale. This has meant that industrial policies need to be capable not just of promoting effective supply-capabilities, but also intermediating access to demanding final markets where, typically, buying-power is highly concentrated. The design of the Ethiopian Hawassa Special Economic Zones (SEZ), stands out in recent African attempts to promote manufactured exports is a case in point. The government began the programme by *first* contacting the major global buyers to determine their needs, and *then* designed the SEZ to meet these needs. Simultaneously, it initiated measures to promote linkages and dynamic comparative advantage.

A second relatively recent development which has challenged the supply-oriented approach to industrial policy is an increasingly important role that users have come to play in innovation. The traditional innovation model—a linear, sequential approach to product development—has been supplanted by a more reflexive approach in which users are involved in the innovation process. The benefits of user-led innovation systems are not confined to economies involving high-income and knowledgeable consumers in external markets. They also represent an effective way of orienting industrial development to users in the domestic economy.

A third important demand-related development in recent decades has been the growth of low- and middle-income markets in developing economies. Hundreds of millions of people with low incomes have entered the global market in recent decades as global per capita incomes have grown. Their growing purchasing power represents what some observers have called “the fortune at the bottom of the pyramid”. But because of their limited purchasing power, the products appropriate for these low-income consumer markets are necessarily distinctive and this has created both new challenges and new opportunities for industrial development, particularly for inclusive industrial growth.

2.7.5. Industrial policy as a process

Historically, industrial policy has been heavily documented, and in the case of the Soviet industrial plans and India's industrialization during ISI, prescriptive to a very fine point of detail about industrial resource allocation. "Planning"—following extensive analysis and discussion—preceded implementation. As the head of innovation in one of the world's largest firms (Philips) remarked, "If you don't know where you are going, you will probably land up somewhere else".

Two problems emerged with this dominant mode of industrial policy formation. First, it was most relevant in a stable world, in which multi-year time horizons (typically "five-year plans") were appropriate to relatively stable economic environments. However, one of the dominant characteristics of participation in competitive global markets, and in the context of rapid technological change, is that agility and flexibility are critical requirements of successful industrialization. Hence, continuous change is a core requirement of successful policy.

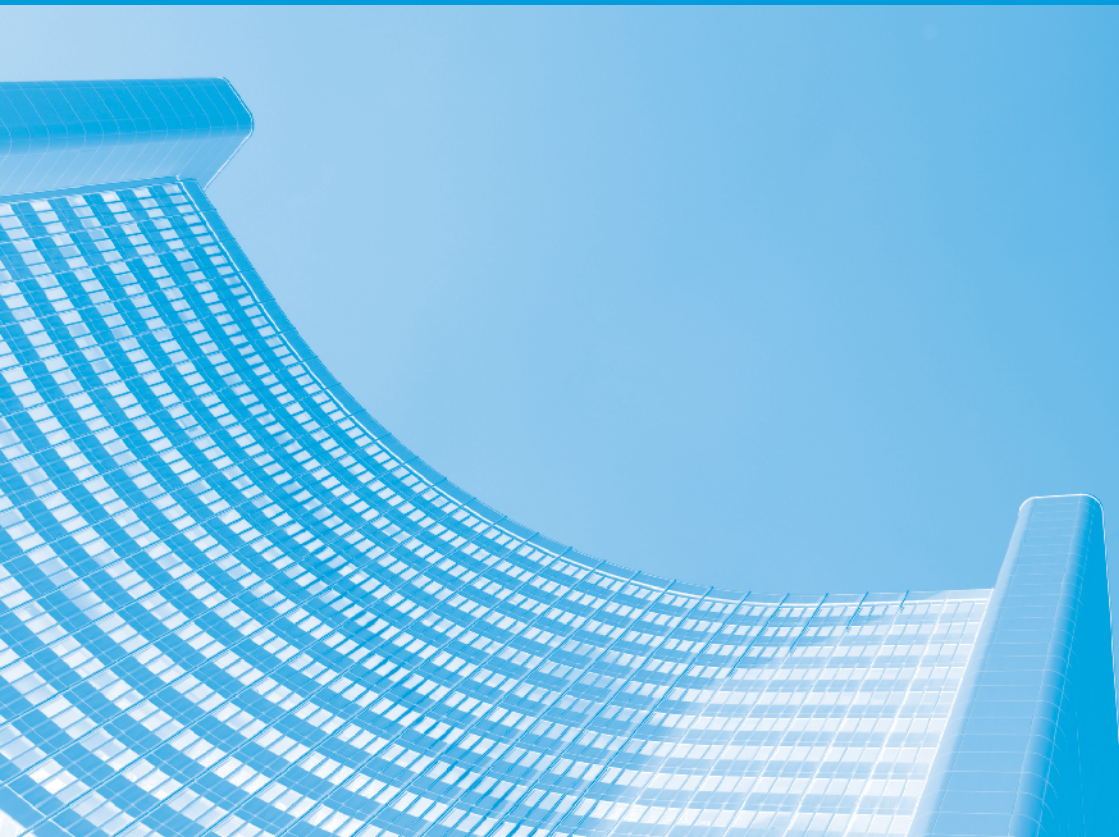
Second, analysis has identified the top-down and sequential character of planning processes as primary explanations of poor rates of policy implementation. The "experts" (however well-intentioned and well-informed they may be) hand down prescriptions to industries and other actors. Those involved in implementation may either not fully comprehend the view of the experts, or not share their judgments. The result is that little of the plan is implemented, or that it is implemented in sub-optimal ways.

These problems of low rates of policy implementation are not confined to the state sector. They also increasingly bedevil the firms in the private sector whose very survival depends on their capacity to adjust flexibly and with agility to rapidly changing competitive environments.

The consequence of these trends is that the challenge in corporate and industrial policy planning has shifted from a top-down expert-informed set of plans to a consultative process in which the stakeholders involved in production (in core parts of the value chain), the government, and other relevant actors (such as in the educational sector) join together in defining and implementing the strategy.

Part 2:

THE ISSUES



UNIDO'S EVOLVING THINKING ON INDUSTRIAL DEVELOPMENT

In this review of UNIDO's activities over the past five decades we refer to two distinct, but related types of UNIDO ideas and contributions to knowledge. The first is the generation of data which provides the raw material used by others to theorize about the determinants, trajectory and impact of industrial activities. The second is the ideas that guided UNIDO's activities, especially those that found their way as a direct contribution to ideas and theory about industrial development.

Despite UNIDO having in its heyday a division made up of four research-related branches and having had renowned intellectuals such as Hans Singer leading the research efforts of the Organization during the days of the Industrial Development Centre in New York between 1962 and 1965, UNIDO was neither established nor ever was a research institution or a think tank for industrialization. However, there are a few areas in which UNIDO not only developed its own ideas but also made a distinctive contribution to knowledge. These accounts are necessarily selective, limited by the length of this book and by the difficulties involved in tracking the early intellectual history of UNIDO.

In Chapter 2 a broad schematic periodization of the evolution of industrial structure, policy and theory was offered in which numerous overlapping and uneven phases were identified. The relevance of these eras of industrial growth to UNIDO's thinking is clear in the eight (necessarily brief) chapters which follow. While there was ample thinking within UNIDO on industrialization issues, in most cases, UNIDO's intellectual contribution to the wider debate was reactive, responding to debates in the external world. But in some cases, UNIDO not only contributed in a responsive mode, but also led the way forward.

CHAPTER 3

UNIDO STATISTICS – A GATEWAY TO GLOBAL INDUSTRIAL RESEARCH

Data are the lifeblood of intellectual inquiry. Without data, there is little prospect of tracking *what* happened in the real world, documenting *when* it occurred, analyzing *why* it happened, assessing its *impact* or plotting its *future*. The development of a comprehensive and up-to-date industrial database—not classified as "research" per se—is perhaps UNIDO's single most important contribution to knowledge and to intellectual inquiry within and outside the Organization.

3.1. From data dependency to a modern statistical agency

UNIDO possesses a unique and distinctive family of statistics on a range of issues related to the development, extension and impact of the global industrial sector on economic growth and development. It is easy to take this extensive database for granted, but this has not always been the case.

Several prominent staff members of this period recounted numerous "growing pains" in the early 1970s, chief among them obstacles to obtaining access to United Nations data in machine-readable form, as was already available to other multilateral organs. All empirical work by researchers at the Organization had to be carried out manually from publications of other organizations at the beginning, bearing obvious limitations on the quality of research.

One of UNIDO's flagship publications of the time was the annual Industrial Development Survey, which suffered from similar constraints. Funding for the survey was rather scarce, and though the series could stoke some scholarly debate, the mentioned data issues presented difficulties in terms of quantifying those ideas.

The situation started to change in 1977 when it was announced that UNIDO would become a specialized agency following the Second General Conference in Lima, Peru. One of the main outcomes was that UNIDO's bargaining power within the United Nations system was strengthened, resulting in an agreement that was reached to allow the Organization to access data in machine-readable form. Subsequently, a Research Division was created which consisted of three branches: Global Research, Sectoral Research and Regional and Country Studies, growing from just five professionals early in the 1970s. A database was established in 1979 within the Regional and Country Studies Branch, and this marked the true beginning of statistical activities of UNIDO.

These developments were followed by the establishment of the Statistics and Quantitative Analysis Branch in 1983. Within a short period, UNIDO became the predominant supplier of industrial statistics at the global level. The Statistics Branch started to produce its flagship Handbook of Industrial Statistics on an annual basis. The branch also developed a National Industrial Statistics Programme (NISP), under which technical assistance was provided to many national statistical offices (NSOs) of developing countries.

Despite this progress, UNIDO still lacked the ability to collect industrial data directly from its member states. This task continued to be carried out in New York by the UN Statistical Office (UNSO). This reduced UNIDOs capacity to produce adequate data contemporaneously. Consequently, UNIDO sought the mandate to transfer responsibility for data collection from the UNSO and this took several years to accomplish. Finally, in 1993 the United Nations Statistical Commission, the governing body of the international statistical system, provided UNIDO with the mandate to collect industrial data. It was also decided that the OECD should collect its data in a mutually agreed format and transfer these data to UNIDO for global compilation and dissemination.[2]

The granting of this broad mandate to provide statistical output prompted a period of reflection and debate within UNIDO. One view was that UNIDO should produce a flagship publication similar to that of other international organizations. This resulted

[2] In 2013 UNIDO obtained the mandate to compile and disseminate mining and utilities statistics.

in later years in the publication of the Industrial Development Report on a biennial basis from 2002-2003. However, this was a data-intensive task which required a large contingent of capable economists and other researchers, a cadre lacking in UNIDO at that time. Therefore, the opposing view was that UNIDO—as a technical organization with no large group of economists—should make use of its natural comparative advantage in technical fields and focus its research on specific industries of global significance. Under this approach, industrial data would be geared to UNIDO's growing technical assistance programme. In the event, a mix of statistical activities was undertaken, providing both a general industrial database and relevant sector-specific datasets.

Thus, in its statistical capabilities, UNIDO has come a long way from its humble origins. Starting from an era of paper-based data, punch-cards, and main-frame data-sheets in the 1970s, UNIDO now possesses a fully automatic database in the client-server environment. After transformation, cleaned data are stored in the database and made available to a wider audience, not just within UNIDO, but to policymakers and researchers globally through direct access or the world-wide-web.

3.2. UNIDO's manufacturing data as a resource for researchers and policy makers

In the five decades since its establishment, and particularly since the granting of its mandate to collect and disseminate industrial statistics in 1993, UNIDO has developed a suite of databases of invaluable assistance not just to its own internal operations, but to policymakers and the global research community. The following paragraphs will discuss primary databases compiled by UNIDO. These databased are available online and updated annually.

UNIDO Databases

The flagship publication is the *International Yearbook of Industrial Statistics*, which has been published annually since 1994 in conjunction with a commercial publishing house (Edward Elgar), which allows a far greater outreach than internally produced publications. In 2014, UNIDO held an international conference to mark the 20th anniversary of its publication. While the *Yearbook* is the major paper-based statistical publication, the research community and other users can obtain access to this UNIDO data through its online database.

Beyond this aggregate database, UNIDO also makes available a number of more specialized datasets to the research and policy communities.

For example, the UNIDO Industrial Statistics Database provides highly disaggregated data on the manufacturing sector from 1990 onwards at the 4-digit level of ISIC (INDSTAT4). Comparability of data over time and across the countries has been the main priority in developing and updating this database, providing the capacity to analyze the structural transformation of economies over time. The database contains seven principle indicators of industrial statistics covering the number of establishments, employment and wages, value added, output, gross fixed capital formation and annual indices of industrial production. The data are arranged at the 3- and 4-digit level of the International Standard Industrial Classification of All Economic Activities (ISIC) Revision 3 and 4 pertaining to manufacturing, and comprises more than 150 manufacturing sectors and sub-sectors.

The UNIDO Industrial Statistics Database at the 2-digit level of ISIC (INDSTAT2) contains time series data on the manufacturing sector from 1963 onwards. INDSTAT2 is the largest industrial statistics database of its kind. Unlike many other datasets, which have changed sectoral classifications over the decades, INDSTAT2 provides an unchanged and consistent dataset spanning more than 40 years. This makes it particularly valuable for long-term structural analysis. The database contains the same set of indicators as INDSTAT4, covering the number of establishments, employment and wages, value added, output, gross fixed capital formation and annual indices of industrial production. A particularly valuable element in this dataset is that it provides the index numbers of industrial production showing the growth in the volume of production by 2-digit of ISIC Rev. 3. The data are arranged at the 2-digit level of the International Standard Industrial Classification of All Economic Activities (ISIC) Revision 3 pertaining to the manufacturing sector, which comprises 23 industries.

The UNIDO Industrial Demand-Supply Balance Database at the 4-digit level of ISIC (IDSB) contains disaggregated data on the manufacturing sector from 1990 onwards and includes trade data. The data are derived from output data reported by NSOs, as presented in the INDSTAT4 database, together with UNIDO estimates for ISIC-concordant international trade data, utilizing the United Nations Commodity Trade Database (COMTRADE). The database contains data on output and on trade-related items, such as import, export and apparent consumption. The data are arranged at the 4-digit level of the International Standard Industrial Classification of All Economic Activities (ISIC) Revision 3 and 4 pertaining to the manufacturing sector, which comprises 127 manufacturing categories in Revision 3 and 137 categories in Revision 4.

In more specific topics, the MINSTAT – Mining and Utilities Statistics is a new and unique database on mining and utilities sectors. Its development was spurred by the twin observations that in recent decades there has been a steady depletion of natural resources worldwide and at the same time, demand for resources such as crude oil, natural gas and water has soared due to the rapid industrial and infrastructural growth and the increase in global population. In response to increased interest from data users, UNIDO released its first biennial publication of the *World Statistics on Mining and Utilities* in 2010. Users can obtain mining and utilities data in electronic form through online access to this website or by ordering the database on a CD. It contains time series data for more than 100 countries for the period 1995 onwards. Data are presented at 2- and 3-digit level of ISIC Revision 3 and 4.

The Manufacturing Value Added (MVA)database contains country data for GDP, MVA and population for the period starting from 1990 to the latest year available. GDP and MVA data are provided at current and constant prices (2005) in United States dollars. The data in constant prices for latest two years are estimated by UNIDO statisticians. The database is updated annually.

Finally, the Competitive Industrial Performance (CIP) index benchmarks national industrial performance of 118 countries using indicators of an economy's ability to produce and export manufactured goods competitively. An interactive map allows the user to explore the index across countries (The uniqueness and value of this database is described in Chapter 7 in the discussion of technology and capabilities).

Measuring and monitoring progress on SDG9

Finally, UNIDO plays an important role in measuring and monitoring the SDG9. This goal focuses on the contribution of industry to meeting the challenges targeted by the Sustainable Development Goals – "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation". Making progress and achieving these goals requires the development of indicators, and benchmarking of the data over time and space. In meeting the objectives of SDG9, UNIDO has defined six key datasets – the share of MVA in GDP), manufacturing employment, share of small firms in industrial value added, share of small industries in access to finance, CO2 emissions in MVA and the share of medium- and high-tech industries in MVA (Box 3.1). UNIDO Statistics is now working on developing a new database of SDG indicators which, as in the case of other databases, will be made available online to a wider audience of policy makers and researchers.

BOX 3.1

SDG indicators related to Goal 9 Industrialization

- Manufacturing value added (share in GDP, per capita)
- Manufacturing employment, in percent to total employment
- Percentage share of small-scale industries in total industrial value added
- Percentage of small-scale industries in loan or line of credit
- CO_2 emission per unit of value added
- Share of medium- and high-tech (MHT) industry in total value added

Excerpts from Document E/CN.3/2016/2, UN Statistical Commission 47th session

3.3. Building databases for investment promotion in Africa

As the Washington Consensus took centre stage in the developing world, the promotion of private investment became the primary focus on the agenda of virtually every international organization involved in economic development. The preferred mechanism was the establishment of investment promotion agencies (IPAs) aimed at attracting foreign direct investment (FDI). These were modelled along the lines of Irish Development Agency (IDA) and UNIDO's Investment Promotion Services (IPS). Similar institutions located in several developed countries aimed at mobilizing industrial companies in industrialized countries to invest in developing countries.

Successful attraction of FDI, however, required solid and purpose-specific data on the investment potential in recipient countries leading in 2001 to UNIDO conducting a pilot survey of foreign investor in four developing countries. The purpose of the survey was to provide emerging IPAs with insights into why FDI invested, how they viewed their investment, how they valued the service of local institutions (including the IPA) and the sort of engagement that could lead them to increase their investments.

The pilot survey helped to reveal knowledge gaps which were hindering the activities of IPA members:

- The IPAs were unaware of many problems faced by existing investors.
- Investors were not aware of the potential for reinvestment.
- The lack of commitment from governments to promote foreign investment was identified as a major hindrance.
- The weakness of IPAs in garnering resources was hindered by their inability to document the success of their activities.
- The absence of a knowledge-base on the nature of FDI led to a negative perception of investment opportunities in Africa within the international business community. At the same time the public developed negative perceptions of the benefits of foreign investment.
- There was a clear need to focus promotion efforts on specific sectors and economies, but this was hindered by inadequate data on local conditions.

The results of the survey were received well by IPAs and set the scene for a series of African investment surveys, which made a major contribution to the knowledge base on FDI in Africa. From a starting point of 300 firms in four economies in 2001, the knowledge base expanded to 7,000 firms in 36 African economies in 2011 (Table 3.1).The survey design and the analysis of the data linking it to ongoing research was supported by leading researchers on FDI; and the information gained from the surveys enriched UNIDO's technical assistance programmes in African countries.

Table 3.1 UNIDO African surveys (2001, 2003, 2009 and 2011).

Survey	Number of Countries	Number of Respondents	% Foreign investment (More than 10% Foreign)	% Manufacturing	Make up of Sample	Focus of Analysis
2001	4	300	100	No data available	No data available	Investor Satisfaction
2003	10	758	100	67	59% New Green Field; 16% M&A; 25% JV	Investor Structure, modes of entry and operational performance
2005	15	1216	100	48.5	48.8% New Green Field; 11.9 M&A; 39% JV. 46% of Foreign Origin South; 54% North	IPA services with most impact on foreign investors; Expectations of Foreign investors; Analysis of differences in perceptions and investment performance of FDI from North (industrialized countries) and South (mostly China and other emerging economies)
2011	19	7000	36	39.6 for Foreign 44 for Domestic	58% Wholly Owned Domestic; 23.6% Wholly Owned Foreign; 18.4% JV Of Foreign: 53% Origin South; 47% North Of foreign owned manufacturing companies 28% are TNCs and 72% are Fes	Impact of FDI on Domestic firms' performance (first of the surveys to cover both domestic and foreign owned firms). Analysis to correlate investor characteristics (in terms of origin, size, sub-sector, market orientation, entry mode, age) with performance and impact on domestic firms' growth and competitiveness in the same as well as up and down stream sub-sectors.

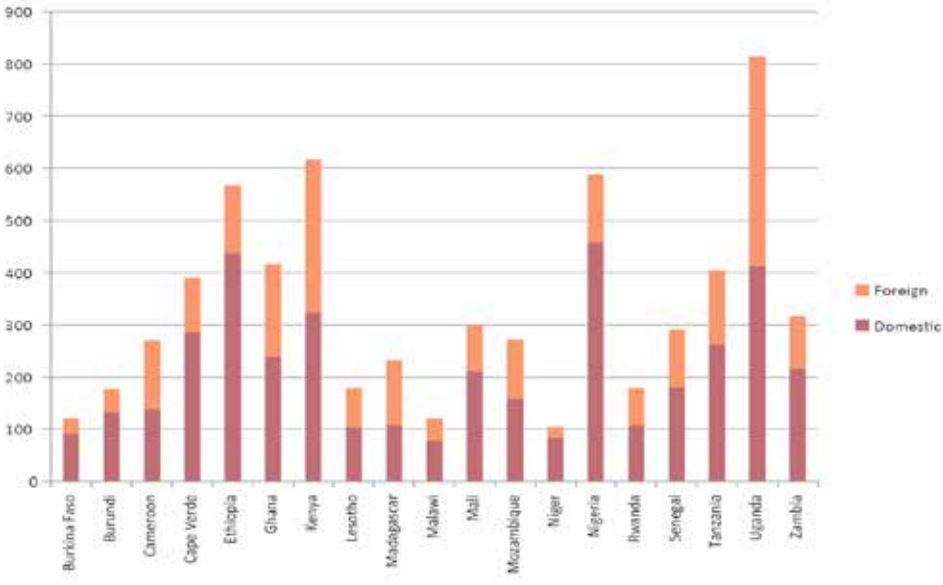
Source: Authors. Calculated from the UNIDO Database

3.4. A comprehensive source of information on investment in Africa

Although the African investment surveys were primarily intended as a practical tool to strengthen the flow and quality of FDI to Africa, they generated unique and comprehensive information covering many African economies over an extended period. The resulting database served as a rich source of information for investors, governments and the research community.

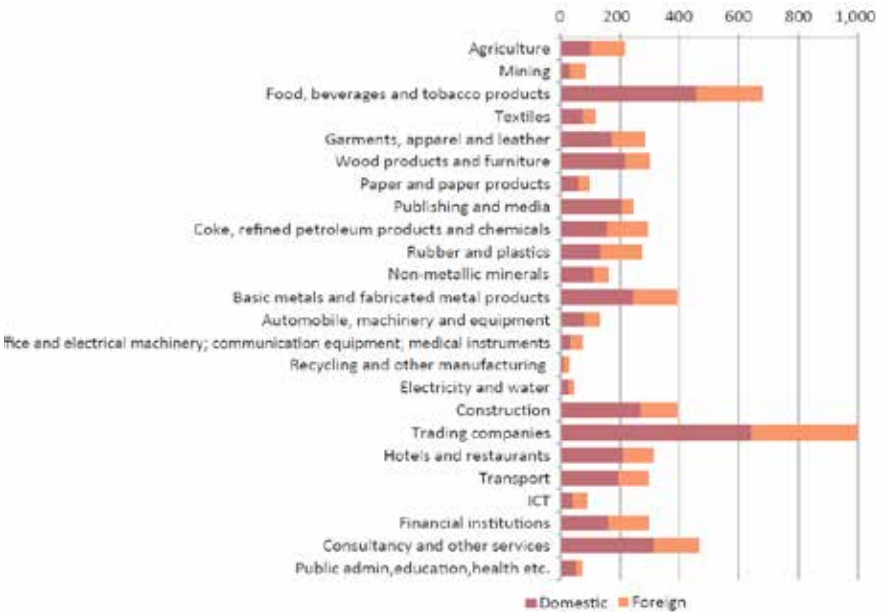
UNIDO conducted its most recent and comprehensive African investment survey in 2010-2011. The survey had four unique features. The first is its coverage: 7,000 face-to-face interviews were conducted with high-level managers in 19 African economies accounting for 42 per cent of African GDP. This represented a major advance in coverage in contrast to the first survey of 2001. The 2011 coverage by country is shown in Figure 3.1 and by sector in Figure 3.2.

Figure 3.1: Country coverage of foreign and domestic investment in 2010-2011 UNIDO FDI Survey



Source: UNIDO, 2011a, p. 183

Figure 3.2: Sectoral coverage of 2010-1011 UNIDO FDI survey



Source: UNIDO, 2011a, p. 184

A second distinctive feature of the 2010-2011 FDI survey is the type of generated data. Here the survey was informed by research on global value chains (Chapter 7). It included questions on the impact of FDI on supply chains, and the role which external buyers played in determining the nature of the FDI and its impact on supply chains.

A third distinctive feature is that the survey sought to generate comparative data, allowing analysis to distinguish between different origins of FDI and between FDI and local and foreign firms (64 per cent of the sample comprised domestically owned firms).

Finally, the fourth unique aspect of the survey was stretching the boundaries of "industry" to include firms from the services sector. This was due to the growing trend of decoupling production.

The 2010-2011 survey sought to address the following knowledge gaps:

- How do FDI operations perform? (methodical comparison in different sub-sectors and countries)
- What are the characteristics of foreign investors who invest in Africa and

operate successfully? (characteristics in terms of growth rates, size, age, market orientation, sub-sector, origin, mode of entry, level of globalization)
- What is the effect of FDI on supply chains?
- How does the level of autonomy of a foreign subsidiary from its parent influence its performance and impact the local economy?
- How does early-stage interaction of a foreign investor with the IPA affect its future performance?
- What would be the effect of improved regional cooperation on growth of investment?
- How important are intra-African investment flows and what drives them?
- What are the sources and costs of energy used by firms?
- What is the role of incentives in driving FDI flows?

A third characteristic of the African investment survey is that it sought to collect data particularly relevant to private sector investors. Whereas in many countries there is extensive data available on the state of the economy (for example, regular surveys on employment, new investments, purchasing managers' report) to support business decision, similar current and reliable data is unavailable in most African countries. Therefore, some of the data in the 2010-2011 survey specifically addressed this gap, and included:
- New investments (and disinvestments) that firms were expecting to make in the next year (by sub-sector and country)
- Changes in inventory
- Top management's perception of business conditions, operating environment, growth prospects, and quality of local services available to firms
- Capacity utilization and, if it was low, reasons for capacity underutilization
- Growth rates in the three years preceding the survey and expected growth rates for the next three years (employment, sales, and exports)

The 2011 survey questionnaire had two main sections. The first related to investor characteristics, such as organizational structure, country of origin, market orientation, share structure, as well as perception questions. The second generated data on enterprise operations, including with respect to output and production factors (labour, physical capital, human capital, energy and intermediate goods, as well as factor prices such as wages). There were also questions dealing with international trade, trade barriers and trade agreements, supply chains, lead buyers linkages and partnerships between foreign and domestic firms. The autonomy of subsidiaries was addressed as a component of questions relating to technology transfer agreements, licensing and franchising.

CHAPTER 4
STRUCTURAL CHANGE

Understanding and promoting structural change, and particularly the part of structural change concerning the growth and nature of the industrial sector, was the core agenda driving the establishment of UNIDO. The intuition goes back to Chenery and Syrquin (1975). Back in the 1960s these authors—drawing on statistical analysis from time series and cross sections—pointed out that successful development resulted from processes of structural transformation that appeared to be uniform across countries. Economies with high per capita incomes had developed manufacturing sectors, and the prospects for manufactures were more favourable than those for agricultural products and services. These more favourable prospects, as was shown in Chapter 2, arose for a combination of reasons: the prices of manufactures were growing more rapidly than those for commodities; as incomes grew, consumers devoted a greater share of their incomes to manufactures; and manufacturing had greater "spillover" effects than those in agriculture and services.

Structure was deemed to be important, not just in relation to the relative contributions made by agriculture, manufacturing and services to GDP, employment and trade, but also because of the composition of different activities within manufacturing. The pursuit of dynamic comparative advantage and the balance of activity between resource-intensive and non-resource-intensive sectors were recognized as important factors in providing employment and sustainable economic growth.

But what does "structural change" mean, and what contribution did UNIDO make to the understanding and analysis of structural change? UNIDO's Industrial Development Report 2013 (IDR, 2013) discussed the definition of structural change in its positive and normative aspects. From a positive perspective, structural change can be defined as any long-term change in the composition of an aggregate. It is generally used to describe changes in the sectoral composition of an economy. From a normative perspective, the concept emphasizes desirability of change. Desirability is addressed in terms of improvements along several sectoral characteristics, the most important being the level and dynamism of productivity and the scope for technological advancement. Structural change in its normative perspective is therefore the ability

of an economy to constantly generate new dynamic sectors characterized by higher productivity levels and increasing returns to scale and lies at the base of economic development. To distinguish the positive from the normative definition of structural change some refer to the latter as structural transformation.

The chapter combines a description of global trends in terms of thinking about structural change with UNIDO interpretations and ideas on the topic. Turning to UNIDO's thinking and contribution to the analysis of structural change, this chapter will identify and discuss six components. The first is the process of change which saw the growth of manufacturing in contrast to agriculture and services. This will be followed by a discussion of the role of manufacturing in economic growth. The third is the changing share of different sectors within industry, which is inter-sectoral change. The fourth component is the changing structure within sectors, that is, intra-sectoral structural change. The fifth component focuses on structural change that is both inclusive and sustainable in the context of the SDGs. And the final component is the changing composition of manufactured exports.

UNIDO's analytical and statistical studies provided a key to the monitoring of these developments (Chapter 3). Without the databases, which UNIDO developed and made available to the public (both online and through publications such as the Industrial Development Surveys), the processes of structural change and transformation of the developing world could not have been tracked.

4.1. Structural change and the big push

Ideas around the central concept of structural transformation and associated techniques of empirical analysis evolved in three consecutive steps.

The first step was during the early 1960s when the focus was on successive stages of aggregate growth, reflecting the basic idea that the quantities and relationships of saving, investment and foreign aid decide on success or failure (Rostow, Harrod-Domar).

The second step emerged during the late 1960s and the early 1970s as the attention shifted to the phenomenon of structural transformation, which was analyzed using a two-sector surplus-labour model (Lewis, Fei-Ranis) that assigned a special role to the high-productivity modern industrial sector as the engine of self-sustaining growth and employment expansion. Chenery and Syrquin's work on patterns of industrial growth was very influential during this period too.

The final step started in the mid-1970s when structural change and patterns of development became the main topics of theoretical and empirical inquiry. In this perspective, development is understood mainly as a sequential process of comprehensive transformation of economic, industrial and institutional structures that is expected to facilitate growth through the rise of new industries. Beyond accumulation of physical capital and formation of human capital, changes in economic structure are required for successful development and sustained growth. The components involved in such structural change range from production, endowment and use of resources, domestic consumer demand and international trade to various socioeconomic and demographic factors. The approach to examining such transformations is twofold, involving theoretical models to explain interdependent structural changes in a given economy and econometric analyses of the corresponding empirical patterns.

UNIDO's contribution to the debate relating to structural transformation was therefore built on the structural-change paradigm that assigned a key role in overall development to the manufacturing industry. The central quantitative measures—interpreted as key indicators of industrial development—were the shares of output, employment, investment and trade of the manufacturing sector and its various industries in the respective total or sectoral aggregates.

Under the theoretical models agenda, UNIDO built a Global Model and put it to use for projections and the construction of scenarios of the global distribution of manufacturing production. A special task in this context consisted in the monitoring and projection of developments that were to lead to achieving the so-called Lima Target of 25 percent as the share of developing countries in world manufacturing production by the year 2000. The Global Report (the then flagship publication of the Organization) served as the main outlet of methodological, analytical and projection results of this exercise.

In the econometric analyses of empirical patterns of structural change in manufacturing production and international trade in manufactured products, the efforts focused on conducting regularly, and publicizing through different channels (such as the biennial Industrial Development Survey) *ad hoc* monographs, as well as contributions to academic journals.[3]

[3] Two other regular series were the UNIDO Country Studies and the UNIDO Industrial Sector Studies. These official publications were supplemented by occasional working papers and issue papers on topics from the realm of structural transformation.

The Lima Declaration, 1975

The Lima Declaration, adopted at the Second General Conference of UNIDO in 1975, was a defining point in UNIDO's history resulting, among other things, in the establishment of UNIDO as the UN specialized agency in 1977. The Lima Declaration was also an embodiment of Rosenstein-Rodan's promotion of a big push based on the structuralist paradigm that was being developed in the organization over years.

The Declaration also set a bold target – the developing world's share in global industrial production had to reach 25 per cent by the year 2000. The achievement of this target not only represented an extraordinarily rapid change in the global division of labour, but also provided the wherewithal for developing economies to tackle the endemic poverty which characterized their economies. It was largely due to decisive action that the Lima target was met; the then existing trajectory of growth was unlikely to succeed. In 1975, the developing world accounted for less than 8.6 per cent of industrial output, and had 62 per cent of the world's population. If the historical rates of industrial and population growth between 1960 and 1975 were sustained, then by the year 2000 the developing world would account for only 13.5 per cent of world manufacturing output and 71 per cent of global population. Achieving the target would necessarily require that the rate of industrial growth in the developing economies be higher than that in the industrialized countries. But what could these relative rates feasibly be?

A UNIDO simulation in the late 1970s—*World Industry since 1960*—projected that the Lima target could be met by MVA output growth in the developed world falling from its 1960-1975 annual rate of 6 to 4.9 per cent with annual MVA growth in the developing world increasing from 7.4 to 10.5 per cent. Achieving these rates of MVA growth in the developing world would exceed the 8-per cent growth rate recommended in the International Development Strategy adopted as part of the UN's Second Development Decade agenda.

The 1975 Lima Declaration sought to achieve its objectives through a combination of changes within developing economies, in the industrialized economies and in the relationships between the developed and developing worlds. Focusing on the developing economies themselves, the Declaration made a clear statement in favour of active industrial policy "the unrestricted play of market forces is not the most suitable means of promoting industrialization on a world scale, nor of achieving international

co-operation in the field of industry". Further, "every State had the inalienable right to exercise freely its sovereignty and permanent control over its natural resources in the manner appropriate to its circumstances, including nationalization".

Complementary investments would need to be made in skills formation, and there was explicit recognition of the need to "make possible the full integration of women in social and economic activities and, in particular, in the industrialization process, on the basis of equal rights". Priority was to be given to agro-industry, but in recognition of the need to promote dynamic comparative advantage, attention had to be paid to the promotion of basic industries such as chemicals and engineering industries. Amongst other things, this would also require measures to monitor and control the transfer of technology from the industrialized economies. Ahead of its time, and probably responding to the environmental debate spurred by the publication of the Club of Rome's *Limits to Growth* Report in 1972, the Declaration called for the need to "conserve non-renewable resources" and declared that all countries (and particularly the developed economies) "must mobilize human and material resources in order to cope with the problems which threaten the environment".

As far as developed economies are concerned, they should aid industrial growth in the developing world by opening markets for developing economy manufactured exports and by establishing a reformed international monetary system in which developing countries would play a major role, ensuring a stable flow of finance to the developing world and introducing such arrangements that "the activities of transnational corporations should be subject to regulation and supervision in order to ensure that these activities are compatible with the development plans and policies of the host countries". Reference to Chapter 2 makes it clear that these various suggested measures placed the Lima Declaration firmly in the camp of ISI, the prevailing approach to industrial development in much of the developing world at that time.

The 1975 Lima Declaration and its Plan of Action, while endorsed by the United Nations General Assembly, were widely perceived to be too optimistic. Yet, astonishingly, the Lima Declaration target was met by the target year of 2000, when the developing world accounted for 27.1 per cent of global MVA. The circumstances in which this target was met were not those predicted at the time. For one thing, in 1975 there was no real sense of what China's share of global MVA was since no comparable data was available to measure the size of its industrial sector. Were this to have been included, the share of the developing world in global MVA would undoubtedly have been higher than 8.6 per cent recorded in 1975. Second, the share of the centrally planned economies in global MVA in 1975 was 27 per cent, having risen sharply from 18 per cent in 1960.

The collapse of the former Soviet Union in early 1990s meant that the *share* of the developing world in a reduced quantum of global industrial production would almost certainly increase as an arithmetical outcome. And finally, as we saw in the introduction to Part 2, although the share of the developing economies in global industrial output rose sharply and met the Lima Declaration target, almost all this improvement was due to industrial growth in Asia in general, and China in particular. African and Latin American shares of global MVA stagnated over this 25-year period.

UNIDO's analytical and statistical studies provided a key to the monitoring of these developments (Chapter 3). Without the databases, which UNIDO developed and made available to the public (both online and through publications such as the *Industrial Development Surveys* and *the Industrial Development Report*), the industrial progress of the developing world could not have been tracked.

4.2. Manufacturing and economic growth

Throughout its five-decade history, the positive correlation between manufacturing growth and broader economic growth has been a major preoccupation for UNIDO, inspiring a substantial body of work. Indeed, the timing of the establishment of the Organization was especially opportune, considering the trends prevalent in the post-war international system with respect to industrial productivity. Broader political priorities, such as the United Nations development decades in the 1950s and 1960s, also provided an impetus.

During one of its first major international conferences following its establishment in 1966 (the International Symposium on Industrial Development in Athens, Greece, in 1967), several trajectories had been noted concerning the changing industrial production in the global economy, relative to the previously dominant agricultural sector. One UNIDO publication noted that during the period between 1938 and 1961, global industrial production had tripled and the share of the industrial sector in terms of world gross domestic product had increased from 30 to 38 per cent (UNIDO, 1967, p.3). This productivity boom was ascribed to several factors such as food shortages and rapidly increasing rates of population growth, but chiefly to the changing relationship between agriculture and industry in the world economy.

A preliminary structural analysis of data provided by 41 countries noted a important relationship between changes in the structure of industrial output and the level of per capita income (UNIDO, 1967, p.6). It was also observed that the increase in the level of

income was characterized by a decline in the share of agriculture within an economy and a concomitant increase in the share of manufacturing. A regression analysis also indicated "a positive and significant association" between the share of manufacturing of an economy in GDP and income per capita (UNIDO, 1967, p.20).

However, it proved unfortunate for the advocacy of the Organization that the release of this data should coincide with a period of fluctuation regarding the growth of manufacturing output and related employment growth in that sector (UNIDO, 1971). Though the global growth of employment in industry exceeded expectations, it was still insufficient to create enough employment opportunities in developing countries. Indeed, in 1967, industrial productivity decreased across all regions and country groupings, save for centrally planned economies, while GDP in most states either declined, stagnated or saw anaemic growth, thus indicating further correlation between the two metrics.

UNIDO research of manufacturing output and GDP indicated an income elasticity of 1:4, i.e. the manufacturing sector could be expected to grow approximately 40 per cent faster than the GDP. However, it was also noted that despite the United Nations Decades, the growth gap between developed and developing countries was continuing to widen (UNIDO 1971).

Table 4.1: Growth of gross domestic product and main economic sectors by region and economic grouping in 1960-1967

	Division of ISIC	Total	Africa	Asia	Latin America	Developed Market Economies	World, Excluding Centrally Planned Economies	Centrally-Planned Economies	World
GDP									
1960-67		4.6	4.0	4.5	4.8	5.1	5.0	6.7	5.4
1967		6.1	4.0	8.0	5.1	3.4	4.2	8.0	4.1
Per Capita GDP									
1960-67		2.0	1.5	1.9	1.8	3.8	2.9	5.4	3.3
1967		2.8	1.5	4.8	0.9	2.6	1.8	6.7	2.7
Manufacturing	2-3								
1960-67		6.3	7.3	6.9	5.9	6.1	6.1	8.3	7.0
1967		4.1	3.7	5.0	4.5	2.6	1.6	10.2	4.0
Agriculture	0								
1960-67		2.5	1.8	2.2	3.6	2.2	2.3	2.4	2.4
1967		8.6	4.2	11.7	4.9	6.7	7.7	-0.7	5.5
Construction	4								
1960-67		5.9	4.6	6.9	5.3	4.5	4.7	5.3	4.9
1967		8.6	9.4	10.4	8.2	2.6	3.4	11.9	5.1
Transportation and Communication	7								
1960-67		5.5	5.4	6.6	4.5	5.8	5.7	7.8	5.3
1967		5.9	1.8	8.2	3.4	5.0	5.0	10.2	6.6
Wholesale and Retail Trade	61								
1960-67		5.3	4.2	5.6	5.2	5.5	5.5	4.8	4.6
1967		6.0	4.9	7.8	5.0	4.2	4.2	11.0	5.0

Source: UNIDO, 1971, p.9.

Some of this stagnation on the part of developing countries may be attributed to the economic model of governance generally chosen following their independence from the colonial powers. While newly-independent countries often followed an industrialization strategy, this was often accompanied by a policy of import substitution, allied with a strong tendency of protecting infant industries. As Hughes (1979, p.16) notes:

"Excessive protection for manufacturing also tended to handicap overall economic growth by raising the costs of inputs into agriculture and other primary production and service industries instead of making such inputs widely and cheaply available. It has usually accentuated regional imbalances by the undue attraction of resources into large cities. It has permitted a great deal of X-efficiency leading to the restriction of potential domestic markets, undue limitations on the scale of production, and further cost burdens to the economy."

At the same time, the success of some developing countries in raising growth levels through export-oriented industrialization strategies (with some exceptions) had been noted. However, it was also acknowledged that overly export-oriented economies have tended to neglect the growth of the domestic market. Thus, a more balanced approach to avoid excess export incentives as well as excess protection was advocated (Hughes, 1979). The multitude of metrics for measuring industrial productivity was also discussed in several UNIDO works of the period, with the Organization giving a qualified endorsement of manufacturing value added (MVA) as the most appropriate indicator in this regard (Hughes, 1979).

In any case, despite the political vigour and desire for self-determination espoused by developing countries through the Declaration on the Establishment of a New International Economic Order and the Lima Declaration, the 1970s were dominated by a series of exogenous shocks which significantly dampened prospects for global growth. These included most notably the collapse of the Bretton Woods system, replaced by a still-evolving system of flexible exchange rates; and the quadrupling of oil prices by OPEC in the mid-1970s (Bos, 1980, p.1). UNIDO research observed that although manufacturing accelerated significantly in developing countries between 1970 and 1976, for example, the balance of growth was decidedly uneven, with the bulk of industrialization taking place in some Latin American and South East Asian countries, as the table below illustrates.

Table 4.2: Average annual rate of growth in manufacturing for developing market economies, 1970-1976 (percentage)

Country grouping or region	Rate of growth
Least developed and other low-income countries	4.7
Least developed	2.5
Other developing countries	8.8
Petroleum-exporting	11.6
Non Petroleum-exporting	8.4
Africa	7.0
West Africa	15.2
South and East Africa	8.7
Western hemisphere	7.3
Average for developing market economies	8.1

Source: Bos, 1980, p.6

Moving in the 1980s, UNIDO research branched out to some extent, looking beyond manufacturing per se and investigating potential spin-off industries, such as industrial services. Industry was found to contribute to employment in urban settings not just through direct employment (manufacturing absorption capacity for labour being relatively limited) but also through industrial service industries (UNIDO, 1985b, p.55). It was also recommended to remove factor price distortions and adopt production techniques to minimize surplus labour, thus increasing employment levels in the manufacturing sector (UNIDO, 1985b, p.89). However, the catalytic role of industry would be to the fore of any strategy for expanding industrial services, and indeed it would be impossible to achieve in isolation (UNIDO, 1985b, pp.89-90). It was also observed that several developing countries had grown due to exploitation of commodities, but had failed to enact the structural change necessary to sustain growth (UNIDO, 1988, p.103).

An evolution in the pattern of regional distribution of MVA for developing countries had also been acknowledged in UNIDO flagship publications towards the end of the 1980s. In the decade from the mid-1970s to mid-1980s, data showed a sluggish upward trend in this regard, rising from 10.3 per cent in 1975 to 11.9 per cent in 1985 (UNIDO, 1988, p.104). This data, showed that developing countries had to accelerate industrial productivity considerably to reach the Lima target of 25 per cent by 2000.

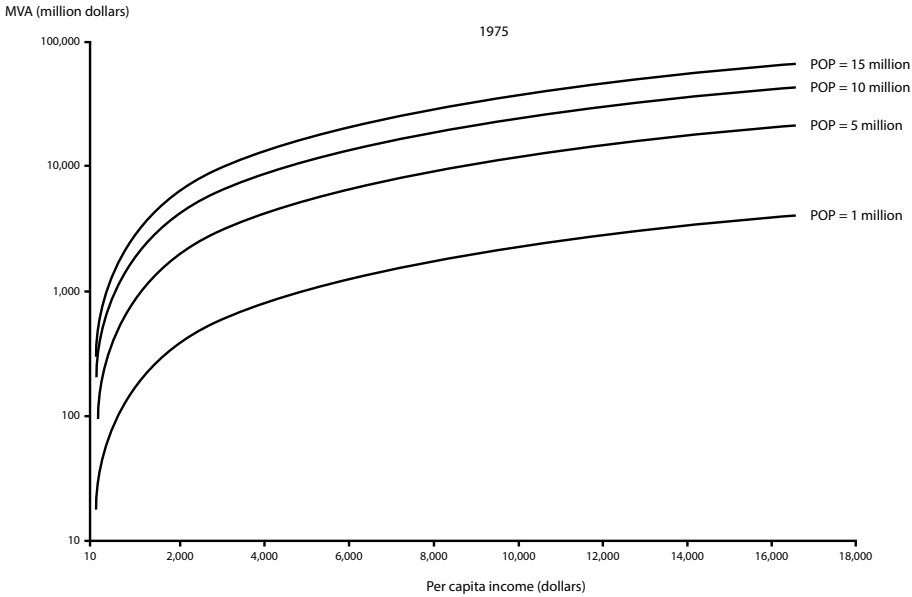
Table 4.3: Regional share of world MVA and regional MVA growth rates (percentages)

				Average Growth Rate	Average Growth Rate	Average Growth Rate
Item	1975	1980	1985	1975-80	1980-85	1975-85
Total MVA	2219670	2701001	3016497	4.01	2.23	3.12
Developing Countries						
Caribbean	5.70	6.00	5.37	5.07	0.01	2.51
Tropical Africa	0.44	0.42	0.4	2.01	1.18	1.99
North Africa	1.29	1.20	1.58	2.62	8.04	5.29
Indian	1.23	1.13	1.27	2.36	4.68	3.52
East and	1.67	2.43	3.26	12.14	8.38	10.24
Total	10.33	11.18	11.89	5.68	3.49	4.58
Developed Countries						
North America	22.10	22.38	22.53	4.28	2.36	3.31
Western	36.33	34.05	31.34	2.67	0.54	1.60
Eastern	19.75	20.03	21.26	4.31	3.45	3.88
Japan	9.47	10.55	11.36	6.28	3.74	5.00
Other	2.03	1.00	1.63	1.54	0.24	0.89
Total	89.67	88.82	88.11	3.81	2.06	2.93

Source: UNIDO, 1988, p.104

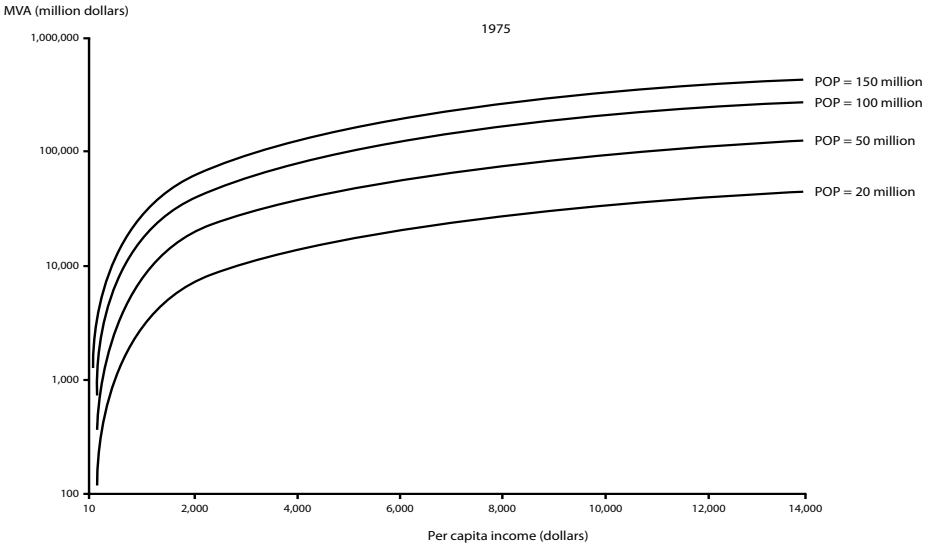
Similarly, UNIDO regression data extracted from a sample of 93 developing countries indicated that MVA increases less than proportionately as per capita incomes rise. It was also found that there were structural differences between small and large countries as proxied by population and that small countries fared better than expected in terms of industrial productivity rates while greater diversity was noted among developed countries in terms of their MVA (UNIDO, 1989, p.118).

Figure 4.1: Relationship between MVA and per capita income in small countries (population less than or equal to 15 million in 1985), 1975 and 1985



Note: The trendlines are derived from the regression equation with a fixed medium for Xm/Xp = 2.59:
$\log(MVA) = -3.5221 + 1.3484*\log(y) - 0.0157*[\log(y)]^2 + 1.0350*\log(POP) + 0.032*\log(Xm/Xp)$.

Figure 4.2: Relationship between MVA and per capita income in large countries (population larger than 15 million in 1985), 1975 and 1985



Note: The trendlines are derived from the regression equation with a fixed medium for Xm/Xp = 1.85:
log(MVA) = -7.0621 + 2.1855*log(y) - 0.0722*[log(y)]^2 + 1.0967*log(POP) + 0.1803*log(Xm/Xp).

Source: UNIDO, 1988, p.103

At the Global Forum on industry held in New Delhi in 1995 industrialization was underlined as the mainspring for economic growth; however, it had been acknowledged that progress had been uneven for developing countries, notwithstanding their collective increase in MVA from 8.6 per cent in 1960 to 21.3 per cent in 1995 (UNIDO, 1995a). It was further observed that there was considerable heterogeneity between regions as to their growth rates, with Asia generally performing better than Latin America and Tropical Africa.

Strong growth of between 6.3 and 7.1 per cent in Latin America and the Caribbean region in the 1960s and 1970s had slowed significantly by the 1990s to an average growth rate of approximately 3 per cent. Growth in South East Asia had also slowed from 11 per cent between 1960 and 1980 to 7.7 per cent in the early 1990s (UNIDO, 1995a).

The Forum was also informed that the decline in manufacturing growth had been felt most acutely in North America, Western Europe and Japan. However, it was stressed that the data in question should be treated cautiously, as it seldom considered the outsourcing of industry-related services. Because such services are heavily dependent on output growth in manufacturing, and because their reclassification as tertiary services rather than manufacturing services is more a question of redefinition than structural change, there was a danger of de-industrialization in those countries being overstated (UNIDO, 1995a, p.6).

Sub-Saharan Africa's MVA had also fallen from 0.4 per cent in 1970 to 0.3 per cent in 1994, with some evidence suggesting that structural adjustment programmes had accelerated de-industrialization in the region (UNIDO, 1995a).

Bearing this evidence in mind, the Forum identified four principal challenges for both industrializing and restructuring countries, namely: (i) the slower growth of early industry, in which developing countries have a comparative advantage, relative to the expansive of high-technology, skills and capital intensive manufacturing; (ii) the rapid acceleration of technological progress possibly giving rise to greater unemployment; (iii) the increasing importance of labour quality for attracting FDI; (iv) the growing realization that foreign investment is insufficient alone for economic development, necessitating also the upgrading of indigenous capacities and private sector (UNIDO, 1995a, p.7).

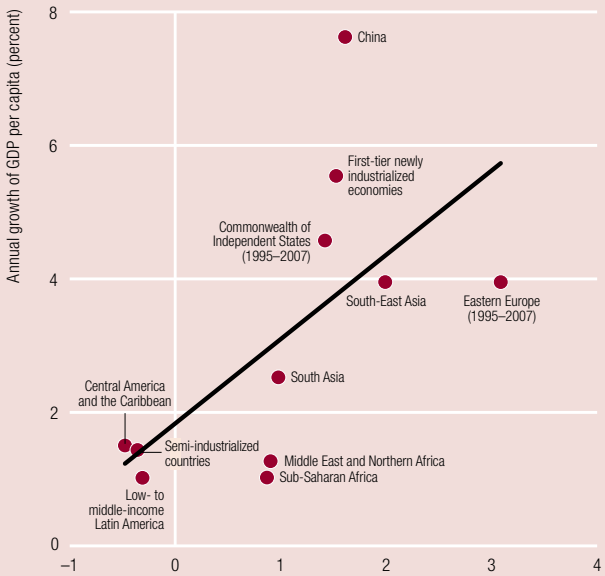
Research on the relationship between manufacturing and growth continued in UNIDO, although its resources dedicated to publications were limited. The 2013 IDR gave prominence to the issue again and produced further evidence on the relationship between manufacturing and economic growth. Country groups achieving the fastest rate of growth between 1970 and 2007 (China and South East Asia) were those who drove industrial development most intensively, whereas country groupings which de-industrialized (mostly in Latin America) achieved only modest GDP growth. This is depicted in Figure 4.4.

This thesis is also supported by several prominent economists focusing on structural change. When structural change is understood from a normative perspective, manufacturing becomes the engine of economic growth, and thus any shift of resources from low-productive activities (such as rural agriculture or urban informal services) towards manufacturing entails an important structural change bonus, in what some authors have labeled "growth-enhancing structural change" (McMillan and Rodrik, 2011).

The literature presents several arguments to support the idea that manufacturing is the main engine of economic growth. Perhaps the most influential came from Nicholas Kaldor in the 1960s. In his view, what distinguishes manufacturing from other sectors is the capacity to generate dynamic increasing returns and thus greater productivity through expanded production.

Following this line of thought Ocampo (2005) also argued that manufacturing is the main driver of productivity growth, due to improvements in the division of labour, technological change and economies of scale. Its dynamism also has key effects on the rest of the economy: its development stimulates, for example, the demand for more primary goods and for better-quality primary goods (in agriculture, forestry, fishing and mining) and services (such as banking, insurance, communications, trade and transport). Manufacturing also generates externalities in technology development, skill creation and learning that are crucial for competitiveness (UNIDO, 2013b, p.4).

Figure 4.3: Economic growth and changes in the share of manufacturing value added in GDP, selected regions and country groups, 1970-2007



Note: The values have been calculated as simple average across the countries included in each group. Sub-Saharan Africa: Cameroon, Ethiopia, Kenya, Mozambique, Tanzania, Uganda and Zimbabwe. Central America and the Caribbean: Costa Rica, Dominican Republic, Guatemala and Jamaica. Low- to middle-income Latin America: Bolivia, Ecuador and Peru. Semi-industrialized countries: Argentina, Brazil, Chile, Colombia, Mexico, South Africa, Turkey and the Bolivarian Republic of Venezuela. South Asia: Bangladesh, India, Pakistan and Sri Lanka. South-East Asia: Indonesia, Malaysia, Philippines, Thailand and Viet Nam. First-tier newly industrialized economies: Republic of Korea, Singapore and Taiwan Province of China. Middle East and Northern Africa: Algeria, Egypt, Islamic Republic of Iran, Jordan, Morocco, Saudi Arabia, Tunisia and Yemen. Commonwealth of Independent States: Russian Federation and Ukraine. Eastern Europe: Bulgaria, Czech Republic, Hungary, Poland and Slovakia.
Source: Adapted from UNDESA (2006a) based on CIC (2009) and World Bank (2013b).

Source: UNIDO, 2013, pp.4-5

Similarly, IDR 2016 extensively focuses on the issue of sustainable development. One of the three dimensions of sustainability is the ability of an economy to sustain growth over longer periods without serious interruption due to economic crises or slumps. The higher the rate of growth, the longer the duration of positive growth rates and lower the volatility of growth rates, the more likely a country is to achieve sustained economic growth. Sustained growth has therefore three characteristics:

1. Average rates of GDP growth per capita. Is growth rapid enough to achieve substantial increases in welfare in the foreseeable future? And is it faster in developing countries than in advanced economies, for example, so that a country can catch up? Since 1950, catching-up has required the growth of more than 5 percent a year, sustained over two or more decades (Szirmai, 2012). Such success is rare.
2. Duration of growth episodes. The ability to sustain growth over longer uninterrupted periods is important, but growth often is not steady and attempting to explain differences in average growth may be misleading. More promising is finding out what initiates or halts episodes of growth, or what influences the characteristics of growth episodes.
3. Volatility of growth. The lower the volatility, the more sustained the growth pattern. Volatility is often much higher in low- or middle-income countries than in high-income economies, and highest in countries that remain in the "development trap" (UNIDO, 2016, p.14).

Not only is the difference in average growth rate among developing countries much higher than among developed countries, but also the volatility of a country's growth rate is higher in developing than in developed countries. Thus, the growth experiences of developing countries vary on the rate, duration and volatility of growth more than those of developed countries. But among developing countries, those catching up seem to have the common characteristics of higher growth rates, longer episodes of growth and lower volatility.

Regarding the duration of growth, countries that remain stuck with the lowest GDP per capita have the shortest growth episodes (seven years on average). Countries that have maintained their position with top GDP rates have much longer growth episodes (17 years on average). But there is not much difference in growth rates. By contrast, developing countries that have improved their relative position over the period tend to have much longer growth episodes than countries that remained in the same position or that have even moved down. We can thus deduce that not only are the growth episodes longer in catchup countries, but they also tend on average to have much higher growth rates (UNIDO, 2016, p.15).

Concerning volatility of growth, we may extrapolate some lessons. First, volatility is much higher in low-income than high-income countries. Second, the volatility of growth of countries that have improved their income ranking is much lower than for countries trapped in the same quintile. Thus, in the long run, less volatile growth is a key ingredient to successful economic development. Not only is the difference in average growth rate among developing countries much higher than among developed

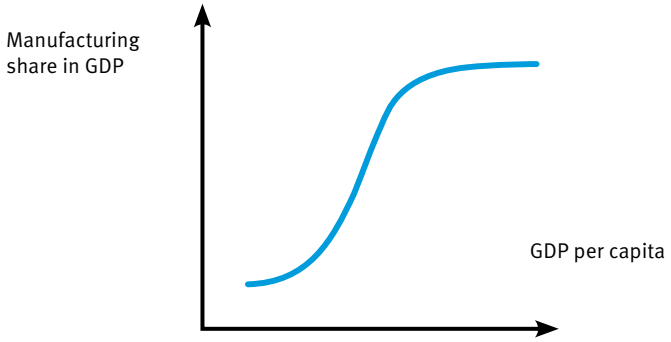
countries, but also the volatility of a country's growth rate is higher in developing than developed countries. Hence the growth experiences of developing countries vary on the rate, duration and volatility of growth more than those of developed countries. But among developing countries, those catching up seem to have the common characteristics of higher growth rates, longer episodes of growth and lower volatility.

Manufacturing can therefore sustain growth by lengthening its episodes and reducing its volatility. The larger the share of the manufacturing sector at the start of a growth episode, the longer growth continues. The share of manufacturing within the modern sector yields similar results, and they have significant positive effects on duration. In line with the effects on duration, the chances of ending a growth spell are substantially reduced as the share of manufacturing at the start of the spell increases. Obviously, the longer an episode lasts, the greater the chances of it finally ending. But clearly the risk is much lower in every year in which the share of manufacturing at the start of the episode is higher (UNIDO 2016, pp.15-16).

4.3. Manufacturing, agriculture and services

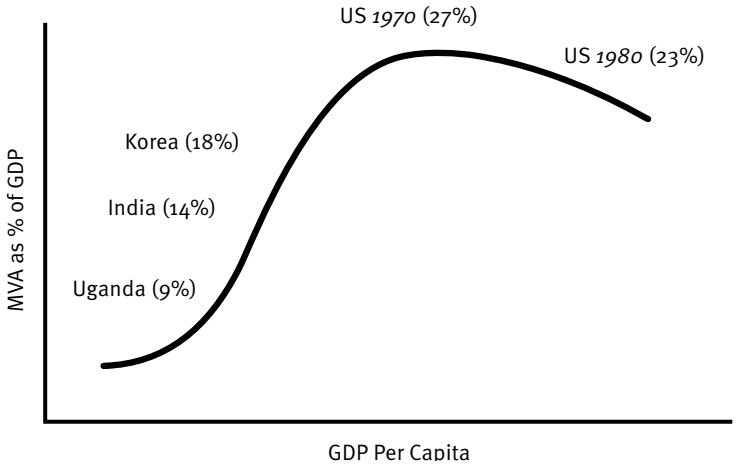
The Industrial Development Survey prepared for the Third General Conference of UNIDO in 1980 set itself the task of analysing the basic trends in industrial development and of documenting the initial progress made in the pursuit of the 1975 Lima Convention's commitment that the developing world would account for 25 per cent of global industry by the year 2000. It began by observing the general relationship between the share of manufacturing in GDP and per capita incomes, noting the existence of an S-curve (Figure 4.1). It was noted that as per capita incomes grew, so did the share of manufacturing. The survey calculated that this growing share was most evident at levels of per capita income which in the 1970s were between US$265 and US$520 (the lower middle-income group of developing economies; US$1,630 and US$3,000 in 2016 prices) and US$521 and US$1,075 (the upper middle-income group of developing economies; US$3,000 and US$6,600 in 2016 prices). But at both the low and the higher ends of developing economy, per capita incomes, the "elasticity" of manufacturing shares (that is, the rate at which the share of manufacturing grew with capita incomes) was much lower than in the middle-income group. TThe share of manufacturing in GDP for a selected set of developing economies in 1970 was compared to the share of manufacturing in the US economy in 1980s, suggesting a growth path of manufacturing in lower income economies as their per capita incomes expanded (Figure 4.2).

Figure 4.4: Illustrative growth path for manufacturing



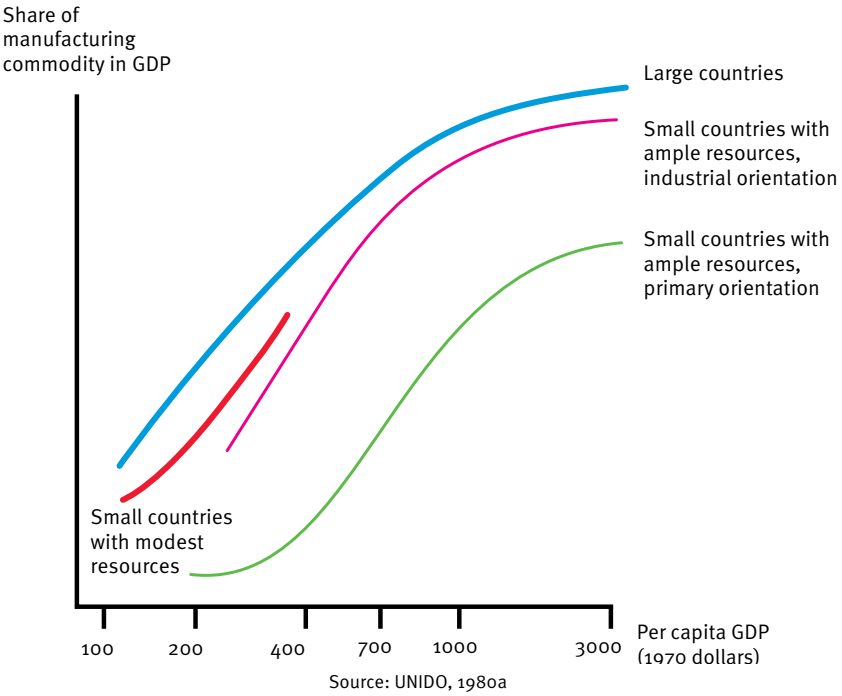
Source: UNIDO, 1980a, p. 45

Figure 4.5: The share of manufacturing in GDP, Uganda, India, Korea and the USA (1970), and USA (1980)



Source: UNIDO, 2012

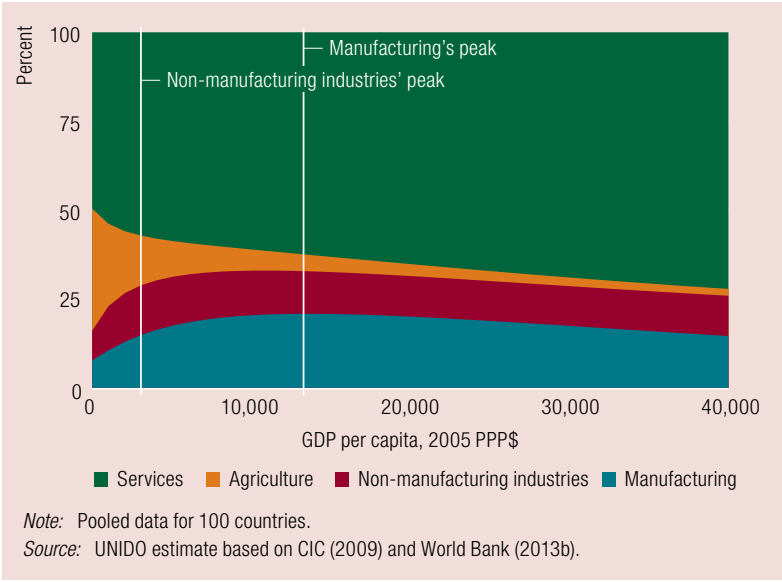
Figure 4.6: Estimated growth paths of manufacturing for four groups of economies, < 1975



Source: UNIDO, 1980a

The 2013 IDR illustrates the extent of the structural change in the global economy from 1950 to 2005. In 1950, just 12 per cent of 68 developing countries' aggregate GDP came from manufacturing, whereas approximately 40 per cent was derived from agriculture. By 2005, the structural dependence on agriculture had completely vanished, contributing just 16 per cent of aggregate GDP of those same countries (UNIDO 2013, p.3). In advanced countries, industry accounted for around 30 per cent of economic activity in 1950, whereas agriculture for only 16 per cent. However, manufacturing had steadily declined in those countries, with its share of global MVA almost the same as that of developing countries in 2005 (Ibid). These ratios are depicted in Figure 4.7 below.

Figure 4.7: GDP composition by income and sector

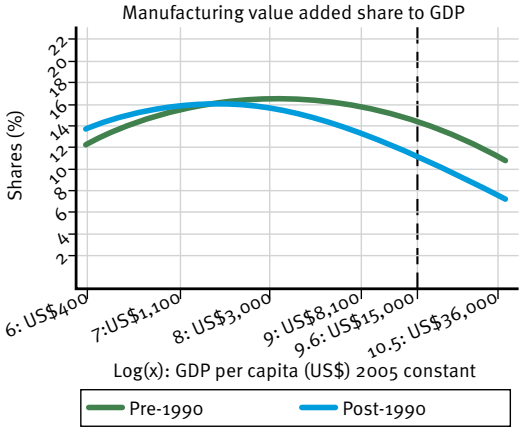


Note: Pooled data for 100 countries.
Source: UNIDO estimate based on CIC (2009) and World Bank (2013b).

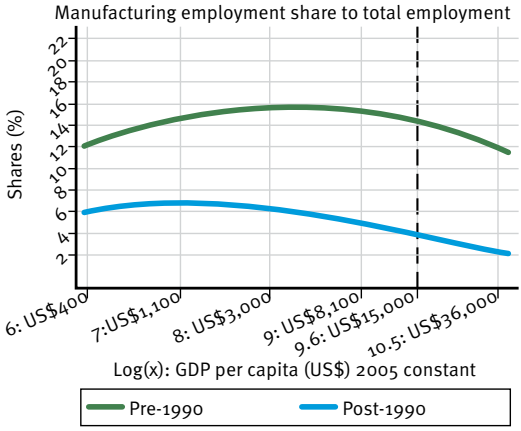
Source: UNIDO, 2013, p.4

The 2013 IDR observed that at very low incomes, agriculture tends to account for a high share of GDP, typically much larger than manufacturing and non-manufacturing industries put together. As income grows, this situation becomes reversed: manufacturing begins to gain ground and reaches a peak of approximately 20 per cent of GDP at roughly US$14,000 per capita income: *"In other words, economic development is associated with a near tripling of the share of manufacturing, largely at the expense of agriculture, whose share shrinks dramatically"* (UNIDO, 2013, p.3).

Figure 4.8: Manufacturing value added and employment shares: all economies



Source: Author's elaboratuon based on WDI (2015) and UNSD (2015, last updated Dec 2014);
Shares calculation: Countries' average [MVA US($) cosntant 2005 / GDP US($) constant 2005], UNSD (2015);
All economies: n=185 (1970-1990); n=205 (1991-1993); n=206 (1994-2010); n=207 (2011-2013)



Source: Authors' elaboration based on Groningen Growth Development Centre (2012), Key Indicators of the Labour Market (2012) and ILOSTAT 2012;
Shares Calculation: Countries' average (Manufacturing employment / Total employment);
All economies: n=109 (1970-1990); n=124 (1991-2012)

Income classification: Higher income at GDP per capita 15,000 (US$) 2005 constant or more;

Model specification: Country fixed effect, log-log quadratic model

Note that the vertical dotted line represents the income levels which separate developing from developed economies.

Source: Haraguchi et al., 2016

UNIDO's analysis of inter-sectoral growth paths sought to determine what variations in economic structure contributed to comparative performance. Using cluster analysis, it estimated that three key structural factors affect the share of manufacturing as per capita incomes increased (UNIDO 1988). The first is the size of the economy – larger economies (a population of more than 12.5 million in 1975) tend to have larger manufacturing shares, reflecting the fact that during this period of largely inward-focused industrialization, economies of scale in the domestic market provide the scope of scale-intensive manufacturing. The second factor was the extent of resource endowment. Economies with what are termed "modest" endowments of natural resources tend to have a larger share of manufacturing in GDP. By contrast, economies with abundant resources tend to have relatively small manufacturing sectors (a result of the so-called "Dutch-disease effect"). And third, within the smaller economy grouping, there is a subset of economies which have, for a variety for reasons, historically developed relatively large industrial sectors. Utilizing data on comparative per capita incomes and the share of manufacturing in GDP during the 1970s, Figure 4.1 provides a rough approximation of what these different sets of economies can expect in relation to the growth of their manufacturing sectors.

In recent years, series of studies have concluded that since UNIDO was established, there has been a structural shift in the relationship between manufacturing and GDP (Haraguchi et al., 2016). As Figure 4.8 shows, comparing the pre-1990 and post 1990-periods, not only did the share of manufacturing in GDP and employment fall as incomes grew, but so did the peaks at which these shares of GDP reached their highest values. If this is indeed the case, it reduces the role manufacturing as a driver for employment growth to some extent, particularly when developing economies reach the middle-income status.

UNIDO's research challenges this relationship in two important ways. First, the method used to make these calculations looks at the relationship between manufacturing in GDP in individual countries, and then calculates the average of these country-specific ratios. In other words, the ratio for China (with its population of 1.3 billion) is given equal weight with that of Mauritius (1.3 million). However, if a different method is used that considers *aggregate* global manufacturing and *aggregate* global GDP, the historic relationship is maintained. These diverging conclusions are explained by the fact that global MVA has shifted to China, and if China is considered just one of many other economies (Figure 4.2 above), it is not surprising that the share of manufacturing in GDP falls as per capita incomes rise. This qualification to the data has important implications since China's economic structure will in the future almost certainly shift away from manufacturing as per capita incomes rise, with industrial production gravitating to other developing econ-

omies. This will reduce the distorting effect which China's share of manufacturing has on the share of manufacturing in global GDP.

Second, as we will see below in the discussion of GVCs, the structure of the post-1990 manufacturing sector changed considerably. This was because industrial firms undertook many components of traditional manufacturing (such as design and marketing) in house, but in the early 1990s they started outsourcing them to specialist business service companies. What was once part of "manufacturing" is now in the "service sector", so that the share of manufacturing in the recent periods will be underestimated compared to its historic share.

4.4. Inter-sectoral structural change

Notwithstanding this general relationship between manufacturing and per capita incomes, which factors determine the share of different sectors *within* the manufacturing sector? The report prepared for the third General Meeting of UNIDO in 1980 documented the changing structure of the manufacturing sector. It distinguished between "light industries" (such as food processing, apparel, wood products, printing and publishing, rubber products and plastics) and "heavy industries" (such as paper, industrial chemicals, petroleum refineries, mineral products, basic metals and metal products and machinery and equipment). The share of these sectors in different developing economies was calculated and case studies were undertaken for many developing economies. It was observed that the light industries, generally relatively labour-intensive and small in scale, tended to be developed before the heavy industries, as per capita incomes grew.

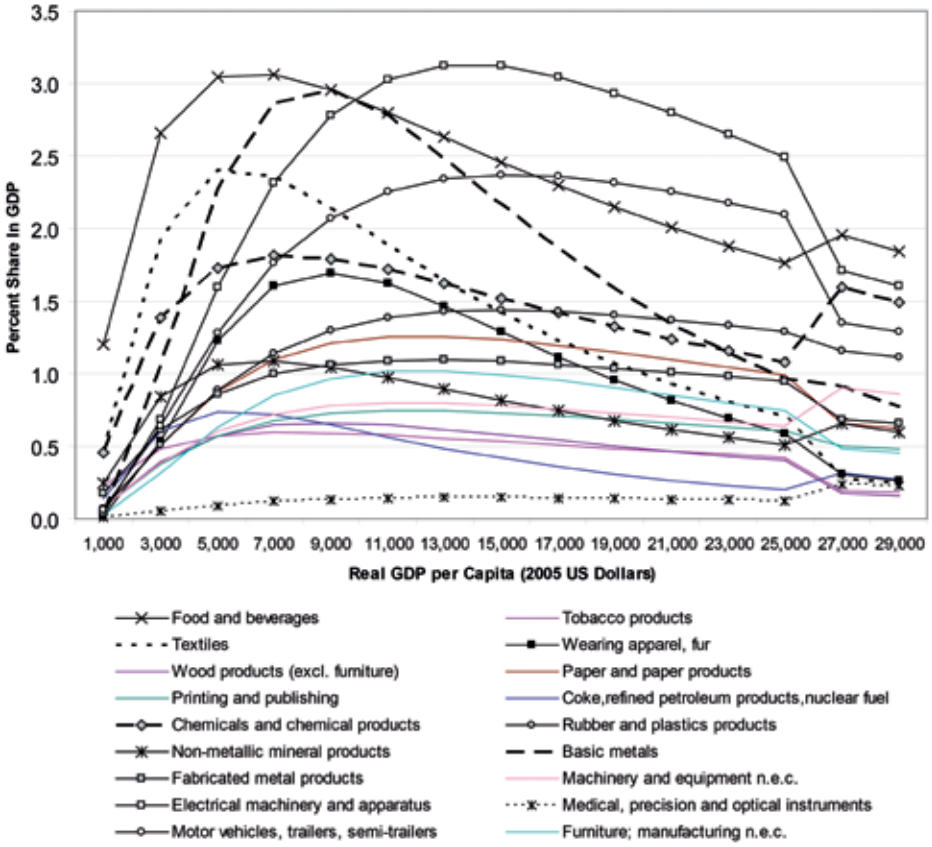
UNIDO updated and deepened this analysis of inter-sectoral structural change and conducted an extensive analysis of what Kuznetz, Syrquin and Chenery had referred to as "normal patterns of industrial development" (Chapter 2). This adopted the same principle which was used to analyze the share of the manufacturing sector in GDP during the 1970s. Namely, it analyzed the share of specific branches of industry in economies at different levels of per capita income and used this comparative analysis to estimate a "growth path" for the structure as per capita incomes grew over time. But the database was more extensive, more recent than the report prepared for the 1980 meeting, and included a much larger set of economies and a more detailed classification of sectors. In the Syrquin-Chenery analysis, the pattern of manufacturing transition was estimated for 108 countries for the period between 1953 and 1983. The recent UNIDO simulation used a larger sample (135 countries), covering a much longer period (1963 to 2006). And whereas Syrquin-

Chenery calculated trends for nine ISIC branches of manufacturing, the recent UNIDO model used 18 manufacturing sectors, at the two-digit ISIC code.

Utilizing this updated and more comprehensive database, the recent UNIDO analysis concluded that "normal patterns" of structural change are affected by three sets of country factors: resource endowment, country size and population density. It concluded, for example, that large countries with high population densities and low natural resource endowments tend to have more developed food and beverage industries during the early stage of their growth than those with low population density and the same country size and natural resource endowment level. The size and natural resource endowment are more conducive to the development of textiles during the same stage. As countries move from low- to medium- and to high-income stages, key sub-sectors for those with higher population density will shift from food and beverages to chemicals, basic metals, and electrical machinery and apparatus. For countries with lower population density, the concentration shifts from textiles to basic metals, electrical machinery and apparatus, and to motor vehicles.

Estimates of sectoral structures were made for different sets of countries, reflecting size, population density and resource endowments. As an example, Figure 4.9 shows the relationship between sectoral shares and per capita incomes in large economies.

Figure 4.9: Change in share of manufacturing sub-sectors in GDP at selected per capita income levels for large countries



Source: Haraguchi and Rezonja, 2011

Amongst the benefits arising from this analysis of "normal patterns" of structural change is that it allows for an assessment of how individual economies depart from these "norms". Table 4.4, for example, focuses on two neighbouring resource-intensive economies—Botswana and South Africa—and identifies which sectors are, relatively speaking, distinctive in their sectoral character. That is, specific sectors are more prominently represented in the GDP structure of some countries than one could expect based on their per capita income. And other sectors are less intensively developed than one could expect. This does not mean that these variations are in any sense "pathological", but it does provide insights into determining the drivers of industrial growth in each economy.

A further take on intra-sectoral change in industry distinguishes between the technology intensity of different branches of manufacturing. Drawing on UNIDO's pioneering discussion of capabilities and technology (Chapter 6), manufacturing sectors can be divided into three groups: high-, middle- and low-technology sectors. The results are somewhat surprising. It could be expected that the higher the level of per capita income, the more manufacturing would be clustered in high-tech industries. And yet, this does not seem to be the case. As Figure 4.8 shows, the middle-income economies tend to have a larger share of MVA emanating from the high-tech sectors than higher per capita income countries. The reason for this is, as will be seen below in Section 4.5 in intra-sectoral change and in Chapter 7 on global value chains, that companies and countries are increasingly specializing in capabilities within sectors. The nature of production in the similarly classified "electronics" sector may be very different from country to country. This shows the importance of drilling down beyond the sectoral aggregates and focusing on sub-sectoral industrial structures.

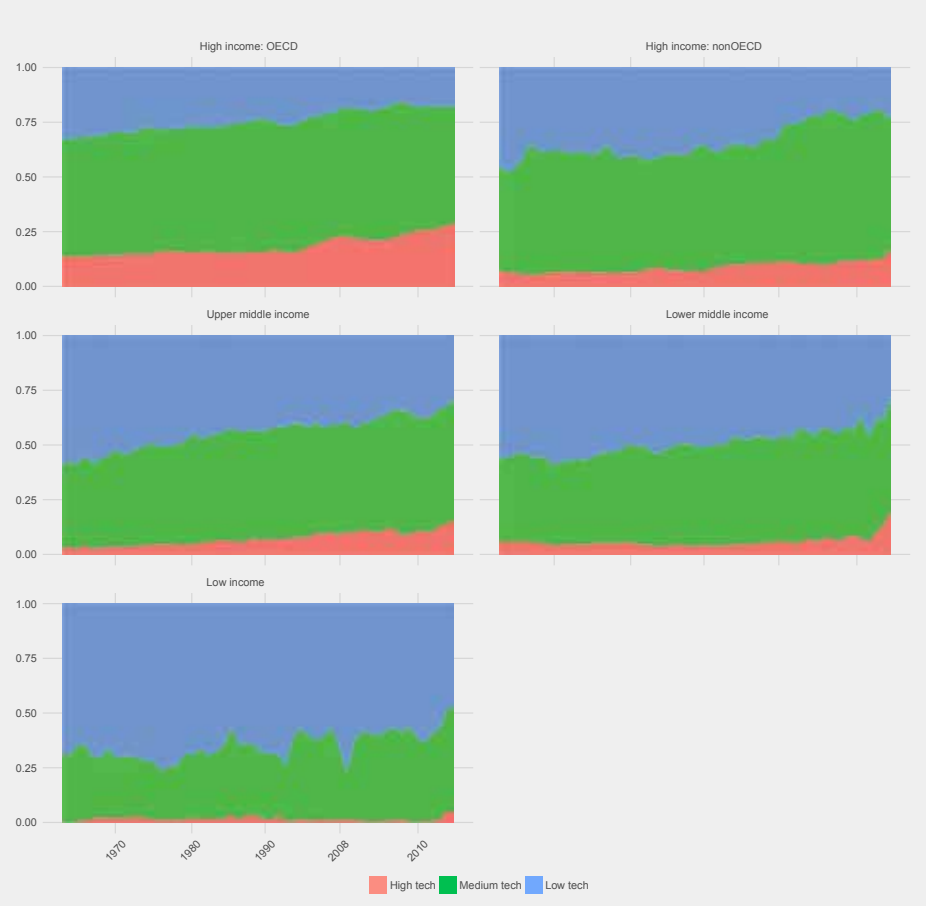
Table 4.4: Below-the-line and at-the-line of "normal" sub-sectoral structures, Botswana and South Africa (2008) *

Country	Below "normal" share in GDP	Near "normal" share in GDP
Botswana	Textiles Food and beverages Apparel and Footwear Paper and paper products Printing and Publishing Chemical and chemical product Nonmetallic mineral products Basic metals Fabricated metal products	Rubber and plastic product Motor vehicles
South Africa	Nonmetallic mineral products Tobacco products Apparel and Footwear Textiles	Electrical machinery and apparatus Machinery and equipment Medical, precision and optical instruments Printing and publishing Wood Products

* Sectors in this list are ordered in relation to their distance from the "normal curve", that is the higher the sector on the list, the further it is from the "normal" pattern.

Source: UNIDO, 2012

Figure 4.10: Share of different levels of technology intensity in the sectoral composition of MVA by level of per capita income



Source: Authors, calculated from the UNIDO database

4.5. Intra-sectoral structural change

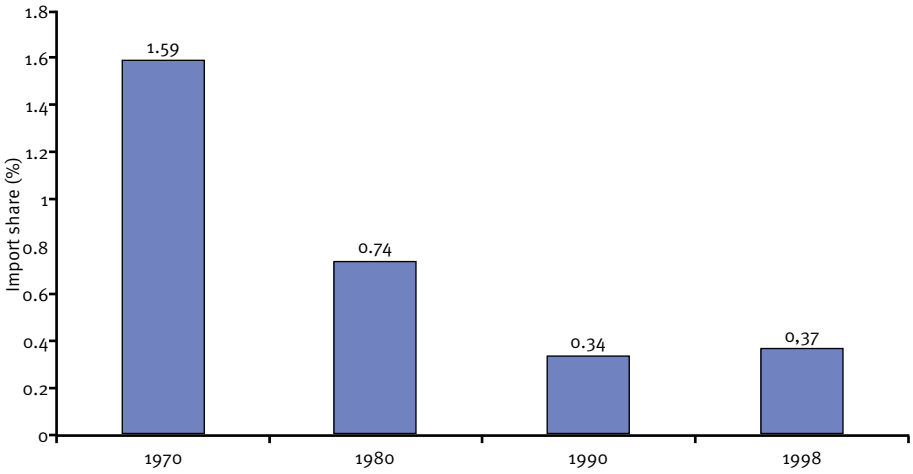
In the mid-1980s, after a long period during which UNIDO had largely been organized on a sectoral basis, the Organization paid increased attention to raising productivity growth in industry. This reflected developments in the growth theory that recognized that technological progress – rather than new investments in physical capital and an increase in the labour force – had been the dominant driver of growth in high-income economies. This was not to say that new investments ("extensive growth") were unimportant, but rather that they were optimally coupled with enhanced productivity ("intensive growth").

This transition from a predominantly sectoral focus to the importance of changing technology and procedures was reflected in the core project work engaging UNIDO and in its analysis of the past, present and future drivers of industrial growth in the developing world.

Macroeconomic and sectoral analyses showed that in many economies the growth of total factor productivity (TFP)—the measure of the contribution of technological change to growth—had slowed down. This was particularly affected the least-developed economies and changed their comparative performance against high-income and other developing economies. UNIDO research showed, for example, that while the average per capita income gap between high-income and developing economies, excluding the least developed economies, remained largely similar between 1970 and 2000 (a 20-fold difference), the income differences between the least-developed and high-income economies doubled from a ratio of 30:1 to 60:1. A primary cause of the gap between average incomes was industrial performance. The ratio between non-least developed developing economies and high-income economies fell during these thirty years from 25:1 to 15:1, whereas the ratio between the least developed economies and the high-income economies grew markedly, from 60:1 to 130:1.

Two sets of reasons explain this lagging performance by least developed economies. The first is that there has been a low rate of investment in capital goods—the machinery required in manufacturing production. Figure 4.19 shows, the share of the least developed economies in global imports of capital goods fell from a meagre 1.5 per cent in 1970 to only 0.37 per cent in 1998. The second reason is the efficiency with which the imported and domestically produced capital goods were utilized. Total factor productivity (which reflects the efficiency of utilizing capital goods) was negative in many least developed economies between 1970 and 1992. This means that despite bringing more resources into production (machinery and people), the total output fell.

Figure 4.10: The share of the least developed countries in world imports of capital goods, 1970 to 1998



Source: Robyn, 2001

Table 4.5: Average annual changes in productivity, best practice and technical efficiency: 32 least developed countries, 1970-1992

Country	Total factor productivity
Angola	0.973
Bangladesh	0.977
Benin	1.010
Bhutan	1.006
Burkina-Faso	0.970
Burundi	0.982
Cape Verde	1.006
Chad	1.029
Dem. Rep. of Congo	0.958
Eq. Guinea	0.953
Gambia	0.971
Guinea	1.003
Guinea-Bissau	1.006

Country	Total factor productivity
Haiti	0.967
Lesotho	0.956
Liberia	0.992
Madagascar	0.985
Malawi	1.003
Mali	0.992
Mauritania	0.954
Myanmar	0.993
Nepal	0.986
Niger	0.949
Rwanda	0.965
Sierra Leone	1.007
Solomon	0.993
Somalia	0.926
Sudan	0.980
Tanzania	0.993
Togo	0.964
Uganda	1.007
Zambia	0.989
Mean	0.982

Source: Forster et al., 2001

The renewed emphasis on productivity and intra-sectoral structural change also helped to shape UNIDO's thinking towards poverty reduction. Here the basic argument put forward by the Organization was that poverty reduction, if it was to become a lasting achievement, would have to rely in one way or another on (productivity) growth and consequently on industry as an engine of such growth.

UNIDO developed policy interventions based on this analysis of low and often falling rates of productivity growth. They included the manifold sectoral support programmes offered to individual economies, the sectoral studies published to inform policy makers across the developing world, assistance with incoming FDI through the Investment Promotion Centres and Technology Foresight Centres, as well as interventions designed to support the development of agro-business and small firms, including in the informal sector. But there was also room for "soft" industrial policy. The goal of this policy is to foster cooperation between governments, industry, and cluster-level

private organizations to increase productivity by improving workers' skills, regulatory frameworks and infrastructure.

4.6. Inclusive and sustainable industrial development

With the expiration of the Millennium Development Goals (MDG) in 2015, United Nations Member States elaborated a new global agreement to chart development priorities and action for the decades to come: the 2030 Agenda for Sustainable Development. While the MDGs had succeeded in its overarching objective of halving poverty as compared with 1990 levels, most of the associated Goals had been of a humanitarian or social nature, with the economic dimension of development somewhat underrepresented. While the new development agenda had a much more significant economic component, particularly bringing issues of economic growth back into the fore, how was the emerging development agenda linked to UNIDO's ongoing discussions on structural change.

The 2013 Lima Declaration

In 2013, at the 15th Session of UNIDO General Conference, a second Lima Declaration was adopted. It noted that the "underlying principles of the Lima Declaration on Industrial Development and Cooperation adopted in 1975 have stood the test of time." However, it went on,"[s]ince 1975, economic, political, social and technological developments, along with structural changes in global trade, have revolutionized the lives and livelihoods of many. Yet serious structural challenges remain for countries at different stages of development, foremost among which is eradication of poverty." Therefore, in the transition from the Millennium Development Goals (which were due to expire in 2015) to the introduction of the Sustainable Development Goals in 2015, it was necessary to transform the industry in the developing world so that it could deliver not only industrial growth, but also socially inclusive and environmentally sustainable industrial development (ISID). In other words, a second big push was required, but this time to improve the quality of growth as much as its quantity.

The 2013 Lima Declaration set out a central role which industry could play in achieving these goals and in establishing UNIDO's commitment to fostering these processes.

"We believe that the Organization has a particular role as the central coordinator of international cooperation towards inclusive and sustainable industrial development

in the United Nations system and should continue to include industry-related services so that the Organization may fully support in all steps of the value chain. This entails strengthening all of its functions in the fields of technical cooperation, action-oriented research and policy advisory services, standards and compliance, and its convening role. In this sense, the core activities and technical cooperation to be implemented by UNIDO in this context can be expressed in terms of building and qualitatively improving industrial capacities."

Connecting UNIDO's structural change ideas and the SDGs

Arguably, one of the most significant contributions of the 2030 Agenda for Sustainable Development is that it simultaneously addresses economic, social and environmental aspects of development. While UNIDO's thinking over the years had emphasized the economic dimensions of industrialization, UNIDO's renewed mandate as well as the emerging SDGs advocate that the economic drivers of industrial development should be supported by a robust social and environmental framework.

UNIDO contributed significantly to the various input streams towards the elaboration of the 2030 Agenda, in collaboration with United Nations Member States and counterpart agencies.

In September 2015, the United Nations General Assembly approved 17 SDGs. Among them was Goal 9: to "build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation." Most notably, target 9.2 of Goal 9 stipulates that United Nations Member States should "…by 2030 raise significantly industry's share of employment and GDP in line with national circumstances, and double its share in LDCs". Similarly, target 9.4 strives to "…enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, particularly developing countries, including by 2030 encouraging innovation and increasing the number of R&D workers per one million people and public and private R&D spending."

The justification for the inclusion of goal 9 was that manufacturing-based structural change would stimulate other sectors via productive linkages. Expanding manufacturing fuels the demand for more and better primary goods (agriculture, forestry, fishing and mining) and services (banking, insurance, communications, trade and transport). Manufacturing is also the main vehicle for technology development and innovation, representing the hub for technical progress. Empirical evidence shows that manufacturing is, by far, the sector in which most R&D investment takes place. This type of investment, however, fuels overall economic growth.

Globally manufacturing directly accounts for 16 per cent of total employment, with the potential of manufacturing for direct employment generation inversely related to the level of income per capita. Low-income countries will find substantial employment opportunities by shifting from agriculture to labor-intensive industries, while middle-income countries will create jobs by shifting towards more technologically advanced industries and services surrounding them. As industrialization went on it further improved the quality of jobs. Apart from higher wages, more advanced manufacturing jobs typically provide better benefits (e.g. retirement plans, paid holidays, etc.) and security (life insurance, health insurance, etc.) than jobs in other sectors and tend to develop higher levels of skills in employees than equivalent jobs in the rest of the economy.

Structural change and the development of widespread productive capacities are also crucial to address the cyclicality of world markets. Economies go through periods of boom, slow down or even recession. They confront shocks arising from rapid changes in export markets or from the level and direction of international financial flows. Diversified economies are far less vulnerable to rapid changes in economic conditions and far more resilient to confronting related shocks.

UNIDO made a significant input not only in the formulation of SDG9 but also into building connections between industrial structural change and economic growth which eventually led to SDG8 — "promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all".

Economic growth is the increase in the goods and services produced by an economy over a certain period. Economic growth brings prosperity through employment opportunities provided it is sustained over time. Sustained economic growth, in the sense of dynamic, self-propelling or self-fulfilling growth, requires an economy to constantly generate new fast-growing activities or sectors characterized by higher value added and productivity and increasing returns to scale. Manufacturing offers greater opportunities to accumulate capital, exploit economies of scale, acquire new technologies and—more fundamentally—foster embodied and disembodied technological change than other sectors, which is the core of structural transformation. (United Nations General Assembly Open Working Group 2014, p.81)

An expanding economy, however, does not necessarily mean that everyone benefits or benefits equally from the increased prosperity. Between 1990 and 2010 despite the global economy growing at an average rate of 2.7 per cent per year, the OECD countries saw the gap between rich and poor reaching its highest level in 30 years, with the

average income of the richest 10 per cent of the population being nine times larger than that of the poorest 10 per cent. Another evidence of this disparity was observed in middle-income countries: in the first decade of the new millennium, the steady economic growth in those states went hand in hand with growing inequality, with the share of those living in poverty reaching 73 per cent of the world's poor (United Nations General Assembly Open Working Group, 2014).

Addressing inequality is vital because growth has higher impact on future growth in more equal societies. Leaving income and other disparities unattended may even reverse previous economic achievements as people become less satisfied with their countries of residence. Economic growth therefore continues to be necessary for prosperity, but it must be socially inclusive to be maintained in the long run and to achieve social and political acceptance by the majority of the population. Inclusive growth and structural change must give opportunities to all segments of society, especially to socially excluded groups and distribute the income and non-income gains from prosperity more equally across the society. (United Nations General Assembly Open Working Group 2014, p. 81)

UNIDO's ideas on structural change and environmentally sustainable economic growth also percolated into SDG7 — "ensure access to modern, affordable, reliable, sustainable and modern energy for all", SDG12 — "ensure sustainable consumption and production patterns", and SDG13 —"take urgent action to combat climate change and its impacts".

Inclusive economic growth will inevitably reach physical limits if it is not environmentally sustainable. Energy consumption per capita has increased nine-fold over the last 200 years. Materials use per capita more than doubled between 1900 and 2005. Pollution, resource depletion and the waste of discarded products—each at an all-time high—are major causes of environmental degradation and climate change. Continued high resource consumption and reliance on carbon-intensive and polluting technologies will only make matters worse while at the same time sap the potential for further growth and development (United Nations General Assembly Open Working Group 2014, p.82).

The necessary decoupling of economic development from environmental degradation and resource use requires a major structural change in the economy to include innovation in renewable energy and energy efficiency. The conditions for success include profitability, greening demand, dynamism and competitive advantages. Improving the environmental performance of existing industrial facilities is often the

most cost-effective measure to help supply-constrained economies in meeting higher levels of production without exacerbating their impact on the environment.

Similarly, the application of energy-efficient production processes and technologies, along with the enhanced utilization of renewable energy sources, provides an opportunity for countries to follow a low-carbon and low-emissions growth path. Renewable energy plays a fundamental role in satisfying the growing energy demand for electricity, transport, heating and cooling in urban areas, while boosting access to off-grid energy services (solar, wind, hydro, bioenergy, hydrogen, geothermal, wave and tidal generation). Moreover, advances towards energy efficiency are also key for effectively mitigating energy demand and global GHG emissions at relatively low costs. Modern technologies and targeted investment in this context can significantly help to lower energy consumption, reduce emissions and generate income.

It is too early to determine whether these commitments can be observed, but from the point of view of UNIDO's contribution to the development of ideas, the Second Lima Declaration (as well as the First one) and the SDGs represent a powerful example of Rosenstein-Rodan's call for a big push to foster inclusive and sustainable industrialization, structural change and sustained economic growth by 2030.

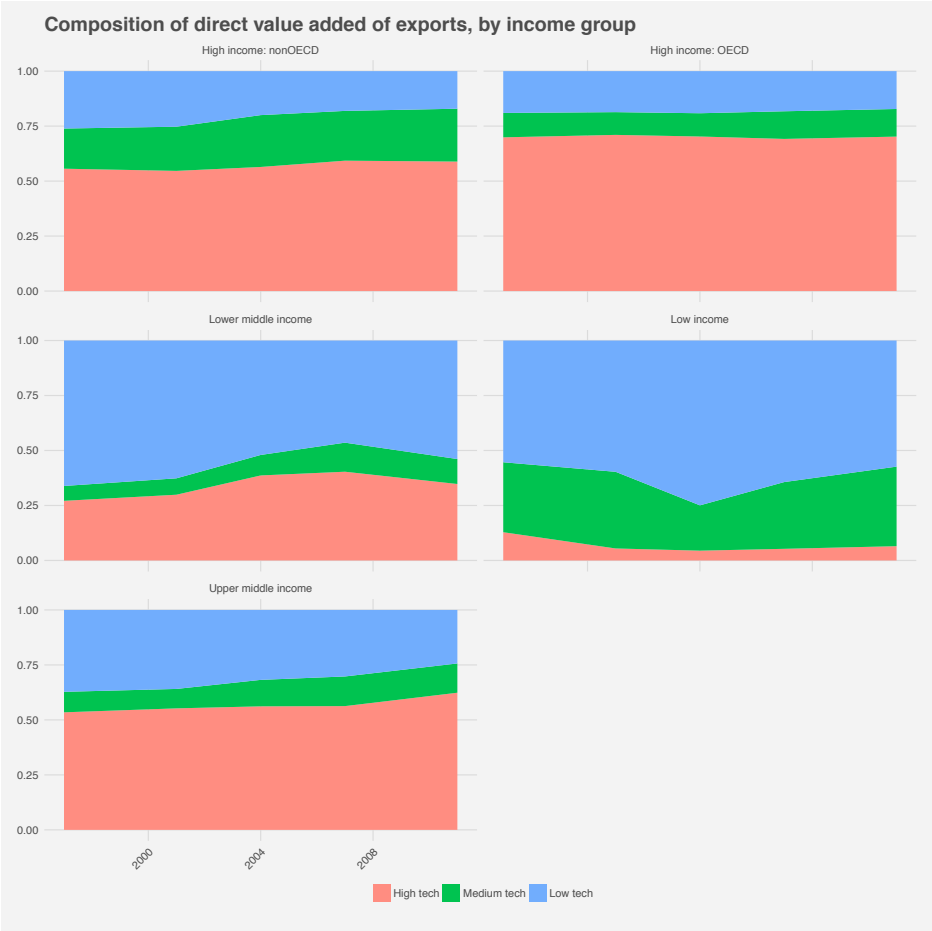
4.7. The changing structure of manufactured exports

The export of manufactures provides multiple economic benefits. First of all, it provides foreign exchange which supports both consumption and the growth of productive capacity in the economy. Second, the rapid growth of exports can be an important source of employment, and successful exporters of manufactures such as China and Bangladesh have seen very substantial employment growth. Third, scale economies are an important source of productivity growth and particularly in the case of small economies, manufacturing exports provide an opportunity to take advantage of these scale economies. Fourth, cooperation in industrial clusters has been an important source of growth in many developing countries (see Chapter 9 on clusters). But cooperation is often hindered by the fear that competitors will steal market shares in restricted domestic markets. If the world (rather than the domestic economy) were the market, this obstacle to cooperation would be reduced. And fifth, exporting can be an important source of learning as firms respond to the needs of demanding consumers and gain knowledge of new and emerging technologies and practices.

The danger of concentrating on the exports of manufactures is that exporting firms and economies may be locked in fierce competition, so that prices decline in what has come to be called a "race to the bottom" (see Chapter 2 on the decline in the world prices of manufactures exported by developing economies). Hence a key industrial challenge is to systematically upgrade the technology intensity of manufactured exports, as was manifestly the case in the newly industrializing "Asian tiger" economies of Asia (Hong Kong, Korea, Singapore and Taiwan) after the 1970s, and in recent years in China.

UNIDO's research shows mixed performance with regard to the changing composition of manufactured exports. The Organization defined four sets of technology intensity in trade (see Chapter 7), which are widely utilized by other researchers. (It is important to bear in mind that, as Chapter 3 shows, the sectoral classification in global trade statistics does not correspond to the classification used in global industrial statistics that was also used to compute the technology intensity of manufacturing in Figure 4.8 above). These are resource-based, low-technology, medium-technology and high-technology manufactures. As Figure 4.10 illustrates, whereas the upper-middle and lower-middle developing economies achieved a significant and sustained growth in the share of technology-intensive manufactured exports, the growth in the share of non-resource-based manufactured exports in the low-income group of economies was confined to low-technology products.

Figure 4.12: The Technological Content of Manufactured Exports by category of country



Source: Authors, calculated from UNIDO database

CHAPTER 5
INVESTMENT AND FOREIGN DIRECT INVESTMENT (FDI)

UNIDO's pioneering efforts to assist countries in deciding how to invest better date back to the first decades of UNIDO's existence. In the 1970s the demand for a proper methodological approach to identifying, formulating, preparing and promoting industrial investment projects lead UNIDO to develop guidelines to assist countries to make sound investment decisions. UNIDO's subsequent contribution to an understanding of the nature, determinants and impact of FDI in developing countries provides an excellent example of the synergy between research, capability-building and policy design and implementation.

The story begins in the 1960s when, as was shown in Chapter 2, import substitution was the dominant industrial policy, often accompanied by a strong commitment to state-owned enterprises (SOEs). UNIDO straddled the divide between Soviet socialism (staff from the centrally-planned economies were strongly represented in UNIDO at that time) and Western capitalism, and most of its early support for investment promotion involved providing technical assistance to countries in setting up SOEs, particularly in heavy industry. This technical assistance was based on several intellectual and applied contributions in the areas of cost-benefit analysis, feasibility studies and FDI lessons.

These intellectual efforts focused on pre-investment and investment issues. The Organization performed a solid amount of work instructing and advising developing countries on best practices. In the 1970s, the UNIDO Guidelines for the evaluation of projects represented a systemic and integrated approach to evaluation and approval of industrial project proposals in developing countries, forming a series of influential reference documents in this area.

The overspills of these Guidelines consequently led to research ventures into neighbouring sectors of investment, such as industrial feasibility studies. The 1978 Manual on Preparation of Industrial Feasibility Studies addressed a critical gap in standardization of industrial feasibility studies, which was a relatively underscrutinized area of inquiry highly popular with government policymakers in many developing countries. More recently, UNIDO addressed not only best practices and guidance but also provision of data on investment issues. This culminated in the 2010-2011 African Investor Surveys, which provided up-to-date data on the effects of FDI on domestic firms, including productivity, but also on a variety of offshoot sectors such as R&D. More details are provided in the forthcoming sections of this chapter.

5.1. UNIDO's pioneering role in cost-benefit analysis

In the field of project economics, one of UNIDO's most durable and intellectually influential work has been the assessment of the efficiency of industrial projects. In the late 1960s and 1970s attempts were made to develop decision-making tools to optimize investment choices. This challenge arose not just because of the need to utilize scarce investment resources optimally, but also because in many cases patterns of technological choice were manifestly inappropriate to the operating conditions in the economy.

Based on the recommendations of the Interregional Symposium on Project Preparation and Evaluation held in Prague in 1965, UNIDO undertook to develop a set of guidelines which developing countries could use for incorporating the evaluation and approval of new industrial projects into their overall industrial planning mechanism. The first document in this regard was the 1972 Guidelines for the Evaluation of Projects, written by three of the most distinguished economists of the time: Amartya Sen, Partha Dasgupta and Stephen Marglin. The original 1972 book was part of a contemporary interest in project economics as a way of introducing economic efficiency into import substitution programmes. At the same time, the 1972 Guidelines represent the cumulative experience of UNIDO in the methodology and practice of national cost-benefit analysis for industrial projects preparation and evaluation. The Guidelines continue to be cited in several recent publications by other international agencies setting out procedures for economic analysis of their projects.

The guidelines introduced social cost-benefit analysis in national economic planning of the time. Social benefit-cost analysis aims to subject project choice to a consistent set of general objectives of national policy. Projects are evaluated based on their total national impact, and the aim is evaluate impact in terms of a set of objectives.

The methodology presumes that market prices in developing countries are not necessarily the prices that should be used for public-sector project evaluation. Alternative prices, which reflect social preferences, are more accurately termed "shadow prices". For example, since many developing economies had a large excess of labour, the real cost of its utilization was often much lower than the wages paid to employees. On the other hand, the scarcity of capital in many developing economies means that the interest rates charged for investment were often too low to reflect the real scarcity of investment.

The Guidelines method of project appraisal breaks down into five stages,each measuring a certain social benefit of the project and is designed to shed light on the project's desirability from a different angle:

- Calculation of financial profitability at market prices
- Shadow pricing of resources to obtain the net benefit at economic (efficiency) prices
- Adjustment for the project's impact on savings and investment
- Adjustment for the project's impact on income distribution
- Adjustment for the project's production or the use of merit/demerit goods such as basic needs and luxury consumer goods whose social values are greater or smaller than their economic values

Benefits and costs are measured in units of consumption accruing at different points of time and, therefore, discounted at the appropriate social discount rate. Various stages of analysis allow a clear statement of project impact in terms of its possible objectives – financial profitability, efficiency of resource allocation, generation of savings and distribution of income. Based on the principles of the economic theory, the Guidelines offer ways to quantify trade-offs between these objectives and draw on the observation of past government decisions to infer government preferences.

The UNIDO Guidelines emerged at a time where a number of other cost-benefit texts were available. The best-known texts were developed by the OECD (Little and Mirrlees, 1969, 1974) and the World Bank (Squire and van der Tak, 1975). They shared a common intellectual framework with the UNIDO Guidelines despite an apparent difference due to the choice of the unit for measuring costs and benefits. In line with standard

welfare theory the Guidelines opted for units of consumption measured at domestic prices, whilst the other two texts used government income measured at world prices. Provided equivalent assumptions were adopted, each approach would give the same accept/reject decision on a project.

The Guidelines approach proved considerably easier to apply in practice. Just like the alternatives, it offered a means of assessing the efficiency of import substitution activities in an intuitively simple way by giving a unique value to foreign currency (termed a "shadow exchange rate") and comparing domestic costs with the value of foreign exchange saved by an import substitution project with the world price of project output converted at the shadow exchange rate. The alternative procedure set out in Little and Mirrlees (1969, 1974) involved the use of multiple exchange rates for moving between world and domestic prices (product specific "conversion factors") and required a lelvel of detail rarely available in practice.

A further important distinctive feature of the UNIDO CBA Manual is that the discount rate which it proposed was one which incorporated the society's preference for benefits now or in the future. This allowed an explicit recognition that investments not only involve the costs of borrowing capital but also a "time preference" between generations, sacrificing present consumption (the current generation) for future benefits (future generations) and is consistent with issues of environmental valuation where long-run effects are common.

As a follow-up to the Guidelines, UNIDO published two less known manuals, the 1978 "Guide to Practical Project Appraisal Social Benefit-Cost Analysis in Developing Countries" by John Hansen, and the 1980 "Practical Appraisal of Industrial Projects" by John Weiss.

The Guide to Practical Project Appraisal aimed to be a condensed and practical guide that makes the methodology of the 1972 Guidelines accessible by wider readership. It retains the stage-by-stage analysis of the original Guidelines, to show decision-makers the effect of a project from different angles (see Table 5.1).

"Practical Appraisal of Industrial Projects" by John Weiss slightly modified some of the steps in the original book and the 1978 Guide and showed how the procedures could be applied to actual industrial projects from Pakistan. At the time it was one of only a small number of detailed applications of cost benefit calculations available for industrial projects.

Table 5.1 The project summary matrix
A. Quantifiable Aspects

Item	Adjustment	Present Value 0%	Present Value 10%	Present Value 20%	Internal Rate of Return (%)
Stage One- Financial Analysis					
Financial Present Value		10000	4581	773	22
Impact of a 10% increase in material					
Costs on benefits		4250	3424	2823	
Adjustment					
Adjusted Values		5750	1157	-2050	13
Stage Two-Economic Analysis					
Economic Adjustments		-5875	-4280	-3144	
Preliminary Economic Values		4125	301	-2371	11
Foreign Exchange Adjustments		3630	2778	2166*	
Economic Values		7755	3079	-205	19
Adjustments					
Output		-20%			
Materials		-15%			
Unskilled Labour		-50%			
Foreign Exchange		10%			
Stage Three-Savings Analysis					
Savings Impact	180%	936	820	63	
Adjusted Values		8691	3899	-142	20
Stage Four-Income Distribution Analysis					
Income-Distribution Adjustment (based on n=0.35)		4013	3458	3046	
Income-Distribution Adjusted Values		12704	7357	2904	24
Stage Five- Merits and Demerits					
Adjustments					
Industrialization (value added)	2%	619	497	407	
Use of Petroleum (Petroleum Inputs)	-10%	-385	-310	-356	
Generation of Employment (Wages)	3%	271	219	180	
Total		505	406	331	
Adjusted Values		13209	7763	3235	29

Items in parentheses indicate the value to which the adjustment factor is applied.

B. Qualitative Aspects

Aspect	Comments
Stage One- Financial Analysis	
Managerial Quality	Managers are able but somewhat inexperienced; management needs strengthening at the middle levels.
Market Potential	Market will depend heavily on the implementation of governmental agricultural credit programme and on completion of irrigation scheme in the north-west.
Stage Two-Economic Analysis	
Economic Impact	Project will relieve agricultural bottleneck by producing tractors currently in short supply owing to foreign exchange security (value of imported content of tractors produced by project will be 30 per cent less than cost of imported tractors).
Production Efficiency	Product will have a good economic rate of return, indicating efficiency of production; however, domestic materials will be procured at relatively high cost owing to monopoly positions of present local producers of inputs; steps should be taken to lower protection to these producers.
Stage Three-Savings Analysis	
Impact of Project	Impact will be positive but marginal; net increase in savings induced will be less than 10 per cent of the present value of the project investment at a 10-per cent discount rate.
Stage Four-Income Distribution Analysis	
Gains and Losses	All groups, including the project, will gain at the expense of the consumers, who will pay an inflated price for their tractors. The largest gainers will be private businessmen, who will gain by selling inputs to the producers at inflated prices, and the unskilled workers, who will receive wages equal to the shadow value.
Stage Five- Merits and Demerits	
Industrialization	Project is consistent with the country's policy of developing efficient heavy industry.
Generation of Employment	Project will offer employment to 5000 workers in a region with high unemployment and considerable social and political unrest.
Environment	Project located in an industrial zone in an urban area; some negative impact in terms of noise and congestion. Excellent design eliminates problems of air and water pollution.
Basic Needs	The impact of the project on the provision of basic needs is indirect and cannot be quantified. However, the light tractors should increase production and lower cost of basic food grains for poor in urban areas.

Source: Hansen, 1978, p.92

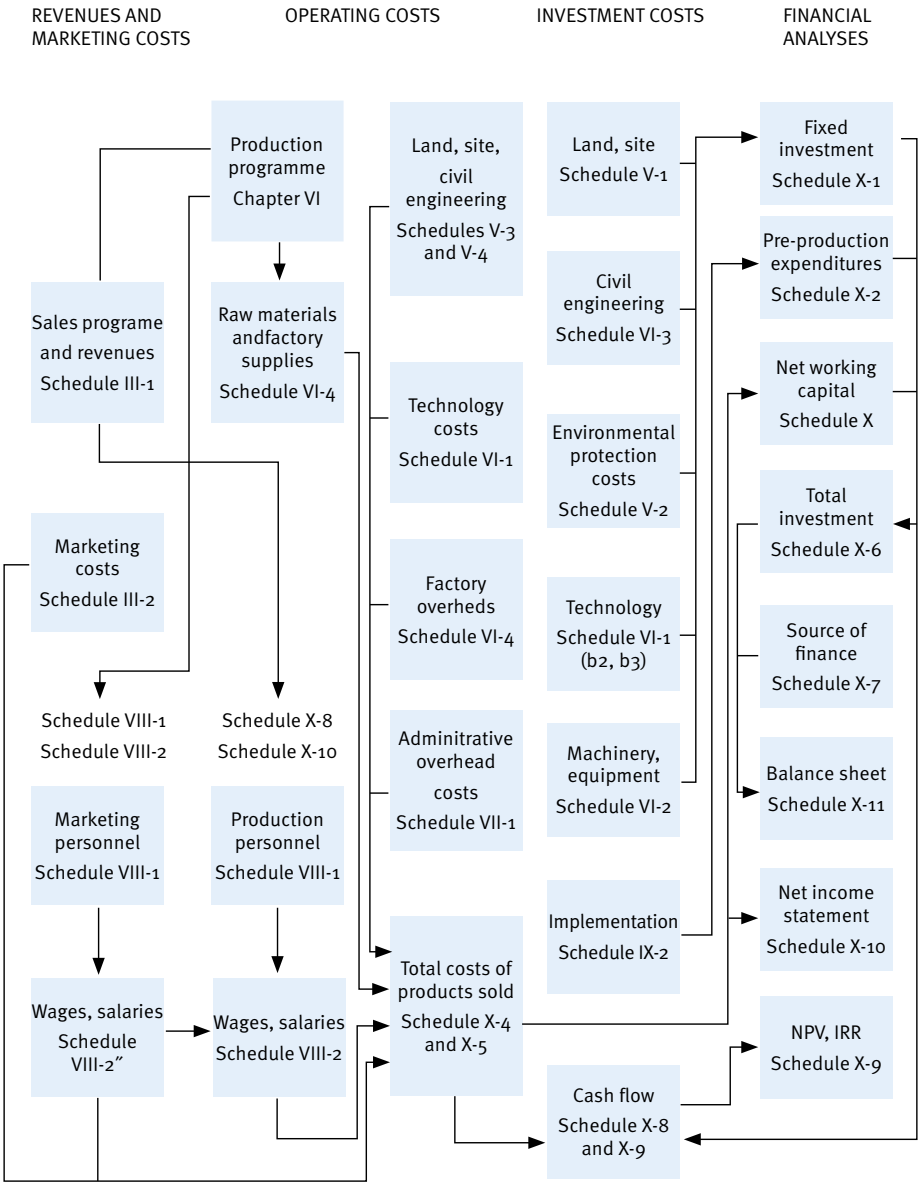
Although the formal stage-by-stage procedure of the Guidelines is rarely followed, the UNIDO methodology, with its use of a single value for foreign exchange, has dominated in the practical application of CBA both by national governments and international organizations, and has stood the test of time relatively well for over forty years. This is particularly the case because the UNIDO approach is easier to apply, once willingness to pay is used as a measure of benefits from goods produced and consumed domestically and for which world prices are not an appropriate measure of value. In this regard the conclusion of the Palgrave Dictionary of Economics entry on CBA is illuminating: "*Many national governments who take their planning seriously … feel more at home with the UNIDO approach*".

5.2. Industrial feasibility studies

Another major contribution that UNIDO made to the international knowledge domain was the *Manual on Preparation of Industrial Feasibility Studies*. The Manual was prepared by Werner Behrens and Peter M. Hawranek of the Division of Industrial Operations Support. The Manual was first published by UNIDO in 1978. By early 1992 more than 150,000 copies had been sold in 20 different languages, making it one of the best-selling UN publications. The Manual was designed to provide developing countries with a tool for improving the quality of investment proposals and to contribute to the standardization of industrial feasibility studies, which had often been found to be incomplete and ill-prepared. The manual contained a detailed guide for pre-investment studies and the investment project cycle and project feasibility study (market research, raw materials, engineering and technology, organization and overhead costs, human resources, implementation planning, financial analysis and investment appraisal).

A feasibility study should provide all data necessary for an investment decision. The commercial, technical, financial, economic and environmental prerequisites for an investment project should therefore be defined and critically examined based on alternative solutions already reviewed in the pre-feasibility study. These efforts result in a project with clearly defined goals and conditions, possible marketing strategies, possible market shares that can be achieved, the corresponding production capacities, the plant location, existing raw materials, appropriate technology and mechanical equipment, and, if required, an environmental impact assessment.

Figure 5.1: Informational flow chart for feasibility studies.



Source: Hansen, 1978, p.35

Table 5.2: Types of decisions to be taken during different pre-investment stages

Decision	Type of Study	Decision Goal
Identification	General or project opportunity studies	Identify opportunity Determine critical areas for support studies Determine area for pre-feasibility or feasibility study
Pre-selection and preliminary analysis	Support studies	Determine which of the possible choices is the most viable Identify the choice of project criteria
	Pre-feasibility studies	Determine provisional viability of project Appraise whether the feasibility study should be launched
Final analysis	Support studies	Investigate in detail selected criteria requiring in-depth study
	Feasibility Studies	Make the final choices of project characteristics Determine the feasibility of the project and selected criteria
Project evaluation	Evaluation study	Make final investment decision
Appraisal report	Appraisal report	

Source: Hansen, 1978, p.355

To ensure the success of the feasibility study, UNIDO's approach emphasizes how the project idea fits into the framework of general economic conditions and industrial development of the country concerned. These considerations include corporate objectives and descriptions of the overall objectives of the project; product location; product and product mix; supporting economic and industrial projects; and economic, sectoral and sub-sectoral project coverage. Supporting analyses, such as pre-investment studies, opportunity studies and pre-feasibility studies, may also be useful complements at this early stage (Behrens and Hawranek, 1991, p.60).

Likewise, UNIDO advocates that the project strategy is central to both the preparation and the evaluation of an investment project, and to the design of a proper marketing concept. It also has a determining impact on the choice of location, technical plant parameters (production capacity, choice of technology, etc.) and resource requirements. The formulation of a project idea should include a description of a preliminary project strategy, such as achieving a production cost advantage over competitors, or penetrating an international capital goods market by cooperating with a foreign partner, or specializing in the manufacture of a high-quality product (Behrens and Hawranek, 1991, pp.63-64).

Further to the strategy, the manual recommends during the feasibility stage of investment the inclusion of market analysis to determine actual and future market volume. It suggests complementing this information with a thorough exploration of the distribution channels that allows reaching consumers rapidly and within the life-cycle of a product, so that the market potential can be additionally evaluated. In terms of environmental considerations, the manual suggests an in-depth study on how the project interacts with its milieu to develop a good multidisciplinary understanding of the underlying causal relations. On engineering, the manual advises the selection of an appropriate technology as well as planning the acquisition and absorption of this technology, and of the corresponding know-how. Finally, firms must also prepare sound financial analysis focusing on accounting principles, and cost accounting and investment appraisals based on economic approaches and acceptable discount rates (Behrens and Hawranek, 1991).

The approach promoted by UNIDO for the preparation of feasibility studies has been adopted by investment promotion agencies, government ministries, universities and other institutions of higher learning, as well as by banks, consulting firms and the investors themselves. The COMFAR software was developed alongside the manual and allowed a systematic approach to feasibility studies.

5.3. A selection of key insights emerging from the 2010-2011 African Investment Survey

The very comprehensive 2010-2011 survey generated an extensive data set, which is available online to researchers (http://investment.unido.org/imp). This provides the opportunity for extensive and intensive analysis of patterns of FDI and its impacts in Africa. A selection of some of the key findings based on the information found in the database.

The extent to which FDI made technology more accessible for domestic firms

Data was collected from domestic firms on how and from where they accessed technology, how much impact FDI had on getting new ideas, how much of their sales was to locally based foreign firms, how much FDI firms contributed to their getting access to hitherto unavailable materials, inputs, equipment, and know-how. The majority of domestic firms indicated that foreign investment in host economies increased their business opportunities and that it had increased demand for their products.

FDI, supply chains and linkages with domestic firms

Data was collected from foreign firms on how much of their material and service inputs were locally supplied, how firms dealt with local and foreign suppliers, how many local suppliers they had, how many were long-term regular suppliers, whether they had a supplier development program, the level of expenditure in supply chain development and on aspects of their suppliers' performance that they thought they needed to develop the most. The objective of this deep questioning was to obtain insights into the backward integration taking place in different sectors and to analyse the characteristics of the type of FDI that was most beneficial in this respect.

The survey showed that 25 per cent of foreign firms contracted out manufacturing operations or business services to domestic firms. Figure 5.2 shows the correlation between backward linkages and FDI. Firms that had the longest experience of operating in Africa had the highest percentage of contracted out work. Joint ventures with TNCs were more likely to subcontract to domestic suppliers than wholly owned foreign subsidiaries, and foreign firms with the highest labor productivity had the highest percentage of outsourced work.

Extent to which FDI enhances the productivity of domestic firms

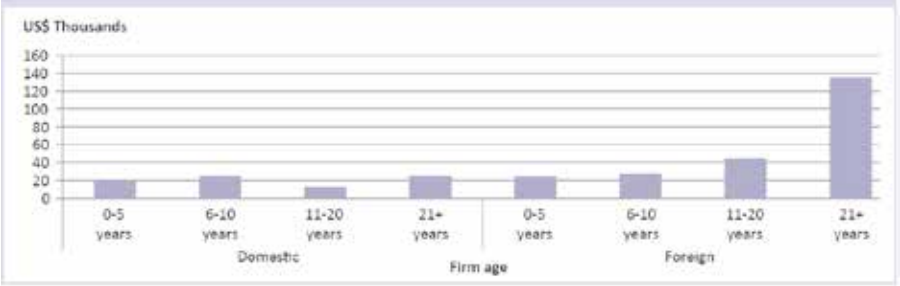
Data was collected at the sector and sub-sector levels to investigate the impact of FDI on various sectors on productivity, output, profits, employment, wage levels and growth of domestic firms.

In some sectors, increased foreign presence led to improved performance of domestic firms, while in others the consequences were opposite. The overall picture was that better-performing foreign firms generally had a negative impact on productivity and profits of domestic firms within the same sub-sector. This, however, seems to apply mostly to TNCs from the industrialized countries.

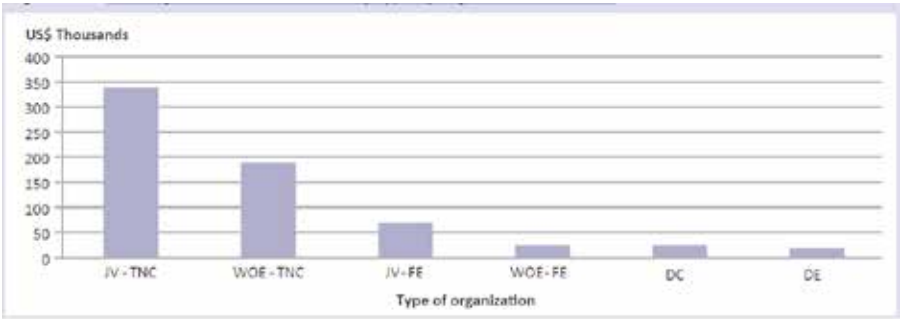
In the case of vertical spillover effects, the overall picture was generally positive. The effect of the entry of foreign firms had a positive impact on domestic firms in other, related sub-sectors. Subsidiaries of TNCs active in low- and medium-technology sectors had the most impact in augmenting the productivity of domestic firms in upstream sectors.

Figure 5.2: Factors associated with subcontracting by FDI in Africa

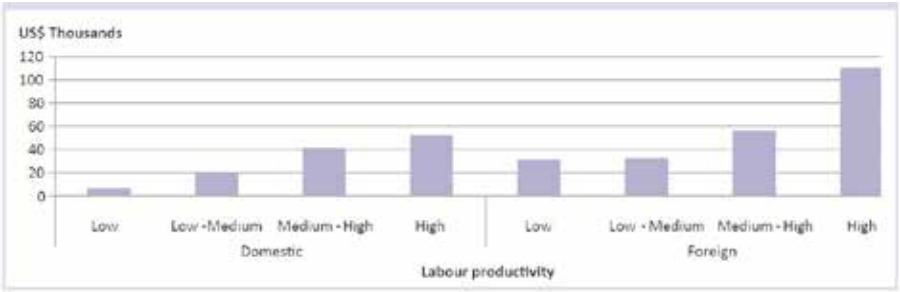
Value of work contracted out, by age of firm, median



Value of work contracted out, by type of organization, median



Value of work contracted out, by labour productivity, median



Source: UNIDO, 2011a, p.79

The productivity of domestic firms in chemicals, rubber and plastics, fabricated metals and garments benefited from the entry of FDI. These are sectors of economic activity showing a high propensity to establish linkages with foreign-owned firms through the production of intermediate products. In terms of output and profits, the presence of foreign firms in low-technology sectors produced positive effects for domestic firms in related sub-sectors. This underscores the important effects of linkages in that when foreign firms established themselves in the survey countries, this generally resulted in an increase in demand for domestically manufactured inputs in low- and medium-technology sectors. Moreover, in these sectors, there were indications of technology transfer, some of which resulted from close cooperation between foreign and domestic firms as well as from demonstration effects and imitation. This phenomenon was confirmed by domestic firms who were asked how they responded to entry of foreign firms in the same or other sectors.

Extent to which firms invested in human resource development and R&D

Data was collected on investments in training and R&D. One of the surprising findings was the positive relationship between expenditures on training and orientation towards regional markets. This could indicate that investment in human capital is one of the strategies regional exporters use to compete in their markets. It is also an indication that as regional markets become easier to access through integration, there will be growth of firms that invest in human capital. This is especially significant since data reveals that domestic firms are more successful regional exporters than foreign firms, and domestic regional-market seeking firms are growing faster in terms of employment and investment.

Reinvestment

Data was collected on investment intentions in the three years after the survey. The foreign investors in the sample planned to make further investments of around US$11 billion and domestic investors around US$9 billion in the 19 countries included in the 2010-2011 survey. This finding underscores the need for IPAs to make aftercare a key element in their services to support investors in bringing these investment intentions to fruition. Reinvestment by existing investors is a very efficient way to promote FDI (in most economies approximately 70 per cent of new investment is re-investment by existing firms). Reinvestment by existing investors is also the best way to convince new investors to enter the market.

Different sources of FDI

The survey revealed the differences in terms of performance and impact of different classes of foreign investors. Important differences were revealed in how investors from Northern industrialized countries and the South interacted with and influenced the performance of local economies. Significant differences were also observed between subsidiaries of large TNCs that set up new subsidiaries in target countries and foreign entrepreneurs (FE), a category created to represent foreign investors not associated with existing enterprises or TNCs but investing as new independent entrepreneurs. The survey revealed that while the largest recent investments were made by TNCs, FEs had a higher propensity to reinvest and, therefore, grow faster.

Size of investments

The largest investments occurred in high-technology sectors, by the most productive firms, mainly joint ventures between domestic firms and TNCs. Labour productivity in the medium technology manufacturing sectors was on average 8.3 per cent lower than in firms operating high-technology sectors. In low-technology manufacturing, firms that specialized in a smaller number of products had higher labour productivity than more diversified firms. This might reflect the tendency of firms in developing countries to engage in task-based specialization of production at certain stages of value chains, rather than in the production of final products.

Productivity

Foreign manufacturing firms had 11 per cent higher labour productivity and 38 per cent higher total factor productivity (TFP) than their domestic counterparts, controlling for all other main differences in firm characteristics. In terms of ownership structure, foreign joint ventures in manufacturing were, on average, two-thirds more productive than wholly-owned foreign firms. Their TFP rates were larger (by about 50 per cent) and they had higher growth rates than wholly owned subsidiaries.

CHAPTER 6
TECHNOLOGY AND CAPABILITIES

As observed in earlier chapters, the five decades of industrial growth since the formation of UNIDO in 1967 witnessed a historically significant change in the global distribution of manufacturing. Two primary and related factors explain these changing global patterns of manufacturing. The first lies on the demand side, where the leading global buyers actively sought to encourage sourcing from low-income economies. UNIDO's contribution to analysing these processes is discussed in Chapter 7 on linkages and global value chains. The second major factor underlying these changes is the growth of technological capabilities in developing economies.

Understanding the dynamics of technology acquisition, choice and development have been key themes in UNIDO's intellectual history. They represent areas where UNIDO has debated over the years and been involved in analyzing these dynamics and generating data relevant to the exploration of these dynamics and to the development of tools to assist policymakers in optimally addressing technology-related issues. A broad distinction can be made between two eras in this evolving discussion. The first is that of the 1970s and early 1980s when developing economies primarily obtained technological inputs through importation from high-income economies and where the emphasis was on technology transfer and technology choice. In the second and more recent era developing economies have also increasingly begun to develop their indigenous technological capabilities.

6.1. The era of technological dependence

The dissemination, acquisition, transfer and licensing of technology became a significant issue in international development in the post-war period, following the realignment of the international system into a bipolar order in which dozens of nations had become newly independent. When UNIDO was established in 1966, industrialized countries enjoyed a dominant position in the global order concerning the ownership of

technology and intellectual property rights. They were the source of most of the world´s manufacturing output and wealth creation. Developing countries, on the other hand, were often dependent on the extraction of commodities, and even in such cases often lacked the requisite know-how to bring added value to their resources compete in the international markets and to achieve higher living standards for their populations.

From the 1960s onwards, the United Nations system became very active in the incorporation of science and technology in development issues. To this end, a United Nations Advisory Committee was established in 1963 by Resolution 980 of ECOSOC. At the United Nations Headquarters in New York, the idea of a World Plan of Action for the Application of Science and Technology for Development was also created as part of the Second United Nations Decade for Development. The specialized United Nations agencies, UNIDO among them, were closely associated with this drive. As a result, by 1970 many Asian countries and several Latin American countries — Argentina Brazil, Chile, Colombia, Mexico, Peru, Uruguay and Venezuela—had created government institutions to develop the institutional framework for this purpose in close collaboration with academia and the scientific and technological communities.

In 1970, the widely-cited Sussex Manifesto estimated that only two percent of global R&D took place in the developing world, and most of this small investment replicated paths of technological development pursued in the industrially advanced economies. Two conclusions followed from this. The first was that the developing economies were reliant on technology imports and that attention should be given to the nature and determinants of technology transfer. The second was that the nature of technological choice was an important determinant of developmental outcomes. UNIDO, in its various activities and publications, made important contributions in these two areas.

A variety of modes of technology transfer were identified during the 1970s, including purchases of technology, the employment of a variety of licensing agreements and the flow of knowledge. In some cases, technology acquisition was conducted as one-off “arms-length” exchanges between buyers in low-income economies and machinery producers in high-income economies. But most often technology transfer was embedded in foreign investment and accompanied by the flow of people, to and from low-income and industrialized economies.

As a 1970 report observed, UNIDO was an early contributor to an awareness that this process of technology transfer from industrialized to developing economies was often suboptimal (Box 6.1). The multiplicity of categories of payment for technology, the lack of transparency in many of these payments (for example, what in concrete terms was covered

by payments for "technical knowhow"?) and the asymmetry in knowledge between technology sellers and technology buyers made it difficult for developing economies to ascertain whether they were being fairly charged for their technology imports.

BOX 6.1: ACQUISITION OF TECHNOLOGY IN DEVELOPING COUNTRIES

"License agreements can effectively contribute to the technological experience of a country provided that they establish a flow of essential technology to that country. To be really effective, the technology obtained through these agreements should be utilized by the whole economy, rather than a limited sector of it, and the agreements should be accompanied by an effort to develop related technologies based on domestic research and local experience.

The Government of a technology-importing country can do much to make the license agreements as effective as possible. They can induce the technology-receiving party or enterprise to place such terms and conditions in the license agreement as may generate a flow of technical know-how that is required and is not merely a repetition of technology already acquired or a business deal in which a firm wants to earn higher profits by producing a patented product of a popular brand. The Government can accomplish this objective through regulation.

The control of restrictive business practices relating to patents and licenses is increasingly necessary, since economic development depends on progress in science and technology; and today most enterprises engage in research and development. Patents can be powerful weapons in competition for the market, and large firms with a proliferation of patents can exert an undue influence on the market.

The development of industries of certain countries may be adversely affected by territorial restrictions imposed by combinations of patent holders. For all these reasons, countries should pay more attention to the problems raised by restrictions relating to patents and licenses and to apply the provisions of their legislation on restrictive business practices more systematically than they have in the past.

A national enforcement agency will be less and less able to proceed against the partners of international agreements because the more agreements come into existence, the greater are the chances that evidence necessary for proceeding against violators of the law is stored in the vaults of enterprises in foreign countries. Thus, closer co-operation between national authorities in this field will become more and more necessary.

While the negative aspects of regulation have received considerable attention in many developing countries and consequently may lead them to avoid the pitfalls and shortcomings in license

flow into the required sectors. This promotional aspect of acquisition of technology must be given emphasis in developing countries. A prerequisite is adequate knowledge of availability of domestic technology in various sectors, together with continuous review of the principal production and technological gaps likely to develop in the economy. Alternative technologies that may be available must also be assessed and the most appropriate available technology selected.

While this task must be left largely to prospective licensees, institutional assistance can be very useful. Assistance in this regard can be provided through more than one agency and need not be confined to the agency responsible for scrutinizing and approving technology contracts. To secure appropriate technology often involves vigorous promotional efforts; and investment centres in industrialized countries are one means some Asian countries have adopted, with good effect, to promote the flow of investment and technology into the desired sectors. Regulation of technology licensing in developing countries needs, therefore, to be viewed from a dual perspective. On the one hand, institutional control should ensure that restrictive provisions in agreements that are adverse to the interests of licensees and the economy should be avoided or minimized as far as possible. On the other hand, positive institutional assistance is necessary to promote the inflow of appropriate and essential technology to cover major technological and production gaps. It is only when a judicious balance has been struck between these aspects that licensing of foreign technology can serve as a really effective instrument for technological growth in developing countries.

Source: UNIDO, 1977, pp.103-105

6.2. Technology transfer

The newly-found urgency of transferring technology to developing countries had already been acknowledged at the International Symposium on Industrial Development convened by UNIDO in Athens, Greece in 1968, which was the first such meeting to discuss exclusively the issues facing the industrialization of developing countries:

"Having little industrial experience, the developing countries lack technical know-how, and their labour forces have not had an opportunity to acquire the skills required by modern industrial technology. Low per capita income, combined with a relatively small total population in many countries, results in domestic markets too small to support efficient manufacturing enterprises, using modern technology, in many branches of manufacturing. The rigid, traditional ways of doing things in these countries often prevent the accommodations necessary for industrial growth." (UNIDO, 1969, p.2).

Even under improved domestic conditions and the existence of technology-transfer agreements for developing countries to access modern technologies, they frequently found obstacles to concluding licensing agreements with technology companies from developed countries. One early UNIDO paper on the issue commented:

*"Existing technology has been developed almost exclusively in the highly industrialized countries and is generally transferred to developed-countries by such means as patent and licensing agreements, the training of technical personnel and the sale of equipment. An international mechanism is needed to assist developing countries in selecting and acquiring foreign technologies most suited to their needs, and to encourage enterprises in the industrialized countries to sell their know-how" (*El-Halfawy, 1972, p.7*).*

Transfer of technology to developing countries at the time was perceived by UNIDO as being further restricted by developed countries' technology owners vis-á-vis technology recipients, including:

- High costs of running royalties, technical fees and lump-sum payments, far above the costs found in arms-length transactions
- Tie-in conditions obliging the recipient to buy from the supplier additional non-proprietary inputs, e.g. raw materials and machinery, at prices without control
- Restrictive clauses preventing the recipients from fully absorbing and mastering the licensed technology and from achieving the envisaged self-sufficiency

Bearing this analysis in mind, UNIDO's position was that for successful technological advancement to take place in developing countries it was necessary to combine internal and external technological efforts through three key mechanisms:

- Imported technological inputs, or technology transfer, either through licensing agreements or through linkages with foreign partners, accompanied by proper mechanisms (including training) leading to the absorption of the acquired technology
- Own technological effort by firms, meaning willingness to grow and internationalize, and investment in R&D, innovation and learning
- Government support with enabling policies and availability of technological infrastructure and supporting institutions and mechanisms

Rather than searching for the most advanced technologies, which were usually too complex to be handled and mastered by domestically available capabilities, the thinking was that developing countries should choose simpler and more manageable technologies (appropriate technologies) that were more labour-intensive, more adaptable to the use of local inputs, such as raw materials and manpower, which would also bring the social benefit of job creation.

UNIDO's position at the time was also that technology transfer should allow the domestic manufacture of goods previously imported. Import substitution policies might, however, also have detrimental side effects, particularly when tariff and non-tariff protection created an excessively sheltered environment that discouraged learning and the pursuit of increased productivity. In response, UNIDO acknowledged in its practice that technology transfer should be harnessed not just as an element of import substitution, but also as a tool to improve the technological capabilities of developing countries and its peoples on a broader scale. Hence, technology transfer should not be a "one-shot affair" but a long-term effort spanning the selection, acquisition, adaptation and absorption of technology, whether imported or indigenous, since technology transfer can also occur between domestic firms.

Following the landmark 1975 Lima UNIDO Conference and the mandate to assist developing countries to achieve the 25 per cent of the global manufacturing value added by the year 2000, the Organization devised the "System of Consultations", as a mean of establishing a continuous dialogue between developed and developing countries on technology issues. This dialogue would seek to overcome barriers and restrictions to technology transfer by producing guidelines and model forms of technology transfer agreements is such fields as pharmaceuticals, petrochemicals and fertilizers.

6.3. Appropriate technology

One of the major debates pertaining to technology transfer during this period within and outside the Organization was that of "appropriate technology". In its Document IDB/188, UNIDO defined the concept in operational terms as underlining the aspect of technological choice and the adoption of criteria for selection which, in turn, depend on policy and development goals. Appropriate technology is thus viewed not an end in itself, but a means to achieve rapid and comprehensive industrial growth and the fulfilment of basic development objectives. It is in fact a derivative of industrial development strategy which itself is part of an overall development strategy.

Following the Tripartite World Conference on Employment, Income Distribution and Social Progress in 1976, it was advocated that the essential elements of an employment-related growth strategy included the following essential conditions: (a) macro-economic policies concerning the production and distribution of essential goods and services, increased mobilization of internal investible resources, effective utilization of natural resources, growth of basic industries,increased diversification of employment and adequate development of human resources; (b) a comprehensive

employment policy; (c) planned growth of the rural sector; and (d) the adoption of technologies best suited to local resources and future growth potential and appropriate national and international action for furtherance of such technological development.

Under this conception of "appropriate technology", an industrial growth strategy must be effectively harmonized with wider socio-economic needs. This may well necessitate considerable reorientation of the future pattern of industrial growth, with far greater emphasis on broad-based industrial development including significant spread of industry to the rural areas.

Foreign technology needs not only to be channelled for selected sectors and on equitable terms and conditions but the choice of technology must be based on local factor-endowments and policy objectives. The inflow of technology should be consistent with the essential need for indigenous technological development and the growth of technological capability. Consequently, while developing countries must ensure the inflow of adequate techniques and processes, it is equally necessary that foreign technology inflow (i) takes place in identified sectors of growth; (ii) is appropriate to factor-conditions and situations; (iii) is consistent with and complementary domestic technological development; and (iv) is made available on acceptable terms and conditions.

At the International Forum on Appropriate Technology in New Delhi, India in 1978, the Organization suggested a new concept of appropriate technology, namely:

*"The search for greater technological flexibility, which is stimulated by typical factor proportions in developing countries, need not involve are turn to primitive processes of production, to nineteenth century designs of equipment or to hand-operated blast furnaces. Rather, it requires a greater readiness to eschew unquestioned adoption of the most up-to-date and most prestigious capital-intensive and integrated production processes, which have been developed for use in countries where labour is particularly scarce and to seek out the efficient processes employed in those developed countries where the relative abundance of capital and labour is somewhat closer to the situation in many developing countries" (*Chebbi, 1978, p.3).

Thus, the Organization posited that the solution for developing countries was not a binary choice between appropriate technology and capital-intensive technology but a judicious blending of the two. Moreover, in searching for technologies, developing countries should start by identifying sectors and activities whose resource endowments match those sectors and activities. While at the time there was no suggestion that developing

countries should seek technology in other developing countries, the argument can be clearly extended in the direction of South-South technology transfer, a precursor of today's emerging technology transfer trends.

6.4. The role of domestic capital goods

While the discussion in some quarters of UNIDO focused on appropriate technology, other parts of the Organization concentrated on how to access capital goods best. An important idea that emerged in the early 1970s at UNIDO was the need to develop an advanced capital goods sector as a means to achieving technological dynamism and independence and address balance of payment limitations. The idea was developed in the context of the NAFINSA/UNIDO Joint Capital Goods Program in Mexico, and spearheaded by Fernando Fajnzylber, who served as the Director of the project from 1976 onwards and eventually became the head of the joint UNIDO-ECLAC (Economic Commission for Latin America and the Caribbean) unit in Santiago, Chile.[4]

The basic argument, which was originated in that context and was later developed and applied in many other projects, was that the absence of a sufficient developed capital goods sector, a characteristic of the industrialization process in Mexico and Latin America, was one of the basic causes of the chronic trade deficit in the region and prevented those economies from reaching higher levels of productivity. The main reasons for the lagging capital goods industry in the region can be traced directly back to the pattern of industrialization followed by its nations. Industrialization policies in the region were usually concerned with the quantitative stimulation of investment, especially private investment and the creation of conditions under which investments would have the lowest possible cost. This condition was achieved, to a great extent, by encouraging the import of capital goods. Stimulus was provided for the production of non-durable consumer goods, and later on, for durable and intermediate goods, but the local production of machinery and equipment, whose initial phase would have raised the cost of investment, was neglected (Fajnzylber, 1978).

In developed countries, the capital goods industry grew at the same pace, if not faster, than other industries. Similarly, in their early days developed countries' investment activities grew faster than their overall economic activities. Furthermore, within the investment activities themselves, the capital goods component grew faster than the

[4] NAFINSA, the Nacional Financiera SNC, is a state-owned Mexican development bank which was deeply involved in financing industrial projects during Mexico's ISI period. Today, the bank continues financing industrial and innovation projects.

total investment. These two trends were linked with the rapid growth and the intensity of technological innovation experienced by the economies of advanced countries. Moreover, technological innovation in the capital goods industry was not only a source of increased productivity in the sector and greater assimilation of innovation in capital goods themselves, but it also increased productivity in the rest of the user sectors. Another advantage was that the capital goods industry also functioned as a payment mechanism for financing the acquisition of natural resources in the international trade of advanced countries (Fajnzylber, 1978).

The importance of the capital goods sector, early highlighted in UNIDO/NAFINSA project, led to other conclusions that shaped Fajnzylber's later work, for example, on how industrialization needs to be "efficient" to pursue two main objectives: growth and creativity. Focusing on the capital goods industry would help to build an "endogenous core of technological progress" that was technologically strong and linked to the whole production system, which is the necessary condition to enter and stay in the international market. In this perspective, the strategic choice was not to promote exports rather than replace imports, but to create this "endogenous core" instead of delegating the responsibility for defining the present and future production and technological structure of a country to external agents. (Fajnzylber, 1983)

The capital goods sector is therefore an "agent for transmitting technological progress", and its expansion promotes technological innovation on an international scale. Countries should focus on the content and quality of the capital goods that they acquire, studying and comparing the technical requirements and the available technologies at the international level vis-à-vis the possibilities of building those technologies locally, before entering negotiations with a specific foreign supplier (Fajnzylber, 1983).

The UNIDO/NAFINSA project in Mexico aimed at the initiation of heavy machinery and equipment production in Mexico, enhancing the technical and industrial interrelations within the capital goods sector and promoting the manufacture of multi-use equipment and components, which were normally only locally produced in low ranges of size and technical complexity with a low degree of integration. The experience gained in the project and the ideas applied in it, inspired other countries wishing to expand their capital goods sector.

6.5. Technology transfer under the Washington Consensus

The dawning of the 1990s proved turbulent in international affairs, with the collapse of the bipolar international order and the concomitant erosion of old certainties. The ascendancy of the Washington Consensus thinking, emphasizing liberalization of trade and investment, led developing countries to give lower priority to regulatory functions. Technology transfer was no longer regarded as a core issue in the North-South development agenda by many countries.

The dominant paradigm stressed several key principles, including:

- The liberalization in progress in the world provided easier access by developing countries' firms to foreign markets, but it also represented serious threats because of unrestricted competition by foreign enterprises.

- The fast technological change and the competitive pressures brought about additional challenges for enterprises, who needed to understand the new realities of competition and implement sound practices of technology management and innovation as indispensable elements to survive and grow.

One of the Organization's most prominent publications on these issues was the UNIDO Manual on Technology Transfer and Negotiation published in 1996. The manual represents the distillation of the knowledge and experience acquired by UNIDO over decades of implementing training programmes on technology transfer and negotiation in developing countries. It contains a comprehensive body of knowledge addressing various issues that a technology buyer is likely to face in various phases of the technology transfer process, with respect to:

- The choice of technology strategies,identification, selection and evaluation of technologies;
- The evaluation and negotiation of contracts; and
- The behaviour of parties to a contract and factors that influence technology options and the result of negotiations.

The manual also provides information on practical approaches and methodological tools for the analysis of legal, technical and economic aspects of technology transfer and acquisition at the enterprise level, as well as on alternative traditional and new forms of technology business, which buyers could explore in seeking technology from other sources.

The Manual not only addressed practitioners of developing countries. It was designed as a tool for technology users from both developing and developed countries observing the legitimate interests of both users and owners of technology.

At a more upstream level, UNIDO's contributions began taking a new dominant paradigm on board. The Third Global Forum on Industry held in New Delhi, India in 1995, delivered some findings and policy-based recommendations concerning technology transfer and practice. From the outset, its delegates recognized that the new international landscape, with increasingly open markets with stricter enforcement of intellectual property rights, meant that technological imitation would play a lessened role in the future (UNIDO, 1995a). The forum also emphasized that technology management, i.e. the ability to effectively integrate the interdependence between technological and other innovations to achieve sustained competitiveness, was an essential capability for fostering technological innovation (UNIDO, 1995a). Participants also elaborated new considerations for countries choosing between licensing agreements and FDI as a means of technology transfer (Kumar, 1995).

6.6. From building domestic capital goods to upgrading technological capabilities

In the decades after the establishment of UNIDO, educational and skill levels rose across the developing world and the share of some developing economies in the global MVA grew. As shown in Chapter 4, structural change was widespread, resulting in the growth of manufacturing, the evolution of its sectoral composition, structural changes within manufacturing sectors, and in the growth of many economies with higher technology exports. At the same time, the opening-up of many developing economies to global competition exposed them to a rapidly changing competitive frontier and to the threats to the sustainability of income growth: *"Latecomers entering global production systems will find it difficult to sustain growth as wages rise — unless they can raise their skill, technological and institutional bases. Plugging into global value chains does not by itself ensure that participants will upgrade their capabilities"* (UNIDO, 2003a, p.2).

Not surprisingly, therefore, the analytical frontier shifted from an investigation into the determinants of industrial investment and the character of technology transfer and technological choice (which had preoccupied theory in the 1960s and 1970s) to a quest to understand the nature and determinants of productive efficiency and innovation.

A focus on the nature and determinants of capabilities was a natural outcome of these developments, and here UNIDO research made a distinctive contribution to the development of theory, generation of appropriate databases and understanding of the social processes underlying the capability growth.

Critically, in the globalization era, the development of capabilities cannot be achieved by the strategy of moving from low- to high-tech sectors as in the earlier phases of industrialization. This is because—as we saw in Chapter 3 —during the 1980s and 1990s global trade was increasingly conducted through the medium of global value chains (GVCs). This meant that firms and economies were increasingly trading in the production of intermediate components and services (with "thin" levels of value added) rather than in final products.

Indeed, UNIDO's 2009 Industrial Development Report provides additional evidence that the production process of many manufacturing activities was subdivided into a series of steps or tasks and that developing countries were working on different tasks. The 2009 IDR further shows that task specialization in developing countries does not necessarily involve entering less sophisticated industrial processes.

The growing importance of GVCs, or trade in tasks, led to a shift in most of the debate on industrial and innovation policy: from sectoral patterns of innovation (changing the sectoral composition of output and exports) to the development of cross-sectoral capabilities. The challenges that these developments brought for theory was substantial — many of the standard concepts (what constitutes a "sector?") and measures (do measures of global trade reflect the value added content of exports?) were no longer fit for their purpose. Moreover, in this new era, what were the primary indicators which could help identify optimal patterns of technological capability building?

The Industrial Development Report (IDR) of 2002-2003 (*Competing through Innovation and Learning*) had also addressed these and other related issues and contributed to shaping the global intellectual and policy debate. It was prepared jointly with a team of leading global experts in the field and was led by Sanjaya Lall. This IDR was a seminal report (not just a guiding industrial policy) making substantive contributions to the development of analytical frameworks, the generation of data and new heuristic categories for data capture and analysis. Its inspiration lay in capturing the evolving business practices in pursuit of lean production, and in evolutionary innovation theories concerned with cumulative trajectories of technological capability development.

BOX 6.2: INDUSTRIAL DEVELOPMENT THROUGH THE DEVELOPMENT OF CAPABILITIES

1. Define and measure performance outcomes

- **MVA per capita**
- **Manufactured exports per capita**
- **Share of medium- and high-tech products in MVA**
- **Share of medium- and high-tech products in exports in manufactured exports**

2. Define and measure practices

- **Skills**
- **Technological effort**
- **Inward Foreign Investment**
- **Royalty and technology payments abroad**
- **Modern infrastructure**

3. Benchmark practices and performance against relevant comparator economies

4. Act on the results

The IDR's focus on capability building began by drawing the key distinction between *practices* (changes in behaviour) and *performance* (changes in outcomes). Indicators were developed for each of these two core elements (Box 6.2). These indicators were then used to benchmark the performance of individual economies and groups of economies with respect to their adoption of capability-building practices and their economic and trade performance.

Measuring performance – the competitive industrial performance Index

The competitive industrial performance (CIP) index measures the ability of countries to produce and export manufactured goods competitively. In its first incarnation in the IDR of 2002-2003, it was constructed from four indicators: manufacturing value added per capita, manufactured exports per capita, and the shares of medium- and high-tech

products in manufacturing value added and in manufactured exports. The first two indicators address industrial capacity. The other two reflect technological complexity and industrial upgrading.

A ranking of 87 economies by the CIP index revealed a general and expected pattern: industrialized economies congregate near the top, transition economies and middle-income developing economies around the middle, low-income developing economies and least developed economies at the bottom. Looking at the regional averages for developing economies shows East Asia leading the CIP ranking in 1998, followed by Latin America and the Caribbean, Middle East and North Africa, South Asia and Sub-Saharan Africa. The stability of the CIP ranking over time confirms that industrial performance is path-dependent and difficult to change.

But the IDR observed that there had been some path dependency (Figure 6.1). Major improvements were made between 1985 and 1998 by middle-income developing economies (China, Costa Rica, Malaysia, Mexico, the Philippines and Thailand). Low-income economies remain at the bottom in the CIP index and the gap between least developed economies and other developing economies widened between 1985 and 1998.

Reflecting UNIDO's ongoing commitment to the analytical development of the CIP index and its usefulness for policymakers, the index was redefined in the 2016 Industrial Development Report to include three sets of indicators:

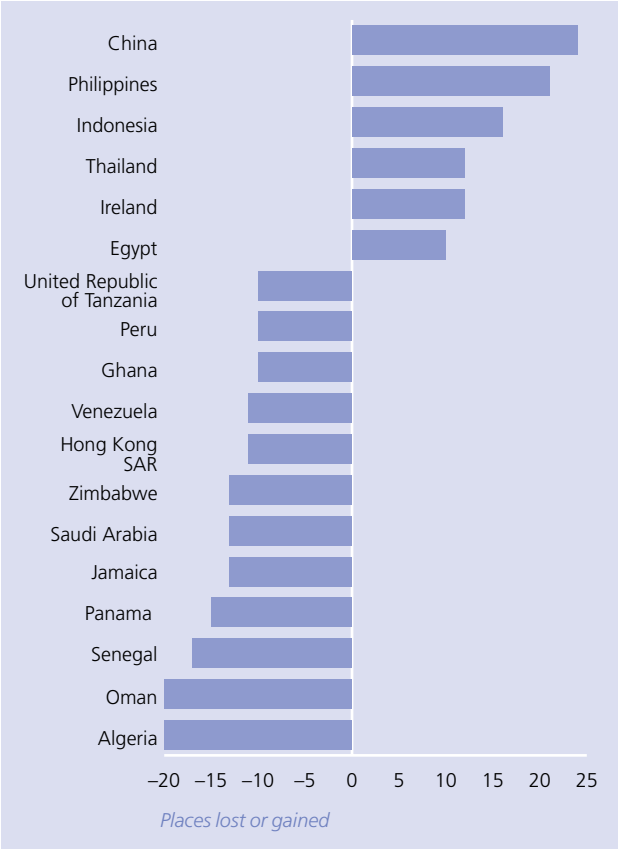
- The capacity to produce and export manufactures is assessed by measuring MVA per capita and manufactured exports per capita.
- The capacity to deepen and upgrade technological capabilities is measured by the share of manufacturing in the economy, the share of medium- and high-technology sectors within manufacturing, the technological complexity of exports and the share of manufacturing in exports.
- The economy's world impact is measured by its share in world MVA and world manufacturing exports.

Capability practices at the economy-wide level – the drivers of capability performance

Rigorous analysis of the structures of the 87 economies whose CIP was measured revealed that five key drivers were closely associated with these successful outcomes — skills, technological effort, inward foreign direct investment, royalty and technical

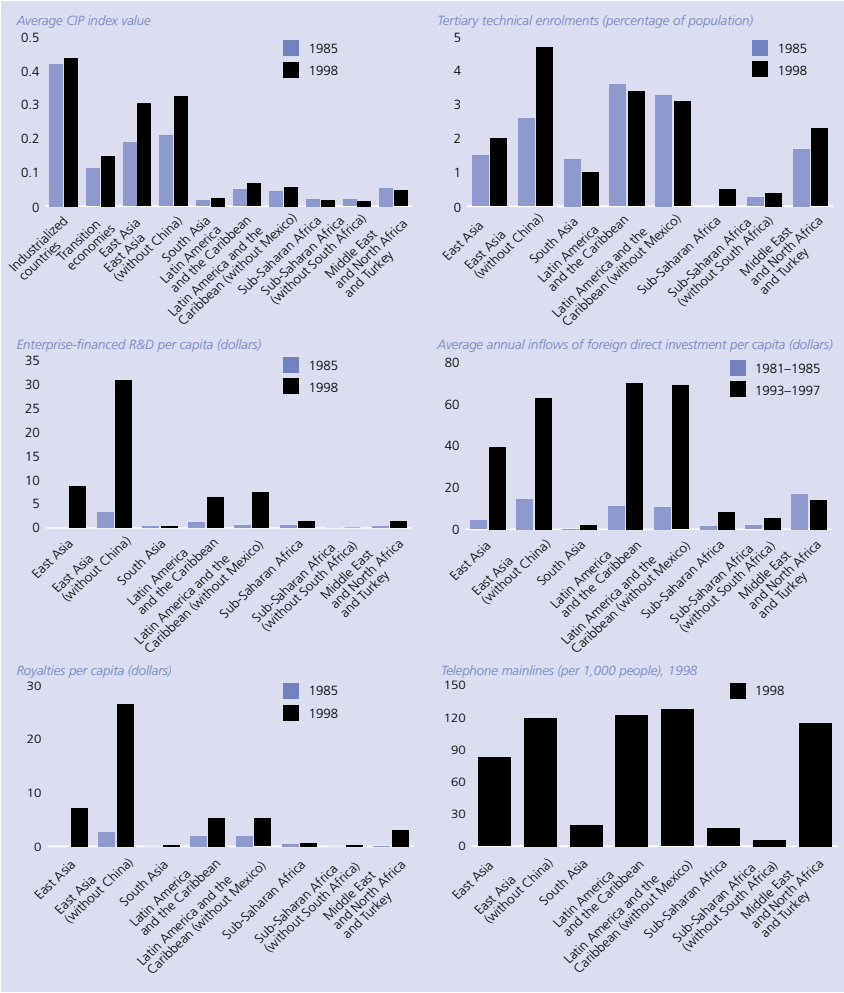
payments abroad, and modern infrastructure. Progress over time with respect to each of these five capability drivers, as well as their competitive performance (measured by the CIP index) over the 1980s and 1990s. In general, there is a close correspondence between the score on the CIP index (measuring outcomes) and performance with respect to the drivers (measuring inputs). Expectedly, the East Asian countries do well in all respects. Relatively high driver scores for Africa with respect to fixed-line telephones and Latin America with respect to fixed-line telephony, tertiary enrollment and FDI do not correspond to their shares of global MVA, showing the importance of a multi-dimensional approach towards the promotion of capabilities and industrial development.

Figure 6.1: Winners and losers in competitive industrial performance rankings between 1985 and 1998



Source: UNIDO, 2003a, p.48

Figure 6.2: Regional performance with respect to drivers and competitive industrial performance (1980s and 1990s)



Source: UNIDO, 2003a, p.58

Similar to the competitive performance index, the ranking of economies by each driver of industrial performance shows considerable stability over time. Thus, the ranking of economies by R&D spending per capita for 1998 is highly correlated with that for 1985, and so on. Nevertheless, some countries managed to change their relative position significantly between 1985 and 1998, such as Uruguay in the skills index, Ecuador in R&D per capita and Tunisia in foreign direct investment per capita.

Indigenous technological effort (proxied by enterprise R&D) appears to be one of the most important factors for improving industrial performance in industrialized and developing countries alike. Foreign direct investment can also help competitive performance (especially in fast-moving industries) as global production systems have grown in importance. And skills and infrastructure continue to be key drivers.

But indigenous technological capabilities do not always match industrial performance. Some economies with high capabilities "underperformed" due to a combination of factors such as disabling regulatory environments and macroeconomic instability. Bahrain, Hong Kong SAR and Panama are among them. Similarly, economies with relatively low capabilities "overperformed", rapidly upgrading their export structures, led by transnational corporations. They include Malaysia, Mexico, the Philippines, and Thailand.

The analysis of technological capabilities during the 1990s showed that among developing economies, industrial capabilities are highly concentrated, with East Asia leading in all factors. Industrial divergence among developing economies is even more acute when looking at technological capabilities. For instance, the bottom 30 economies account for only two percent of developing economy foreign direct investment inflows in 1998, and their R&D expenditure, technology license payments and Internet costs are almost negligible.

Capability-building in the firm

The 2002-2003 IDR analysed not only the determinants of improved competitive performance at the economy-wide level, but also the steps to be taken at the level of the enterprise. Some of these actions were internal to the firm's operations; others involved the manner in which the firm related to external parties.

Focusing on changes within the firm, different sets of practices were identified for the investment stage (when many of the key parameters of future performance are defined) and within production (Figure 6.3). An additional distinction was made between three basic types of firms — those with basic capabilities, those with intermediate capabilities, and those with advanced capabilities. This template, drawing on an extensive set of empirical studies and practical experience with policy, is particularly productive in two respects. First, it provides useful tools at the firm level for managers and workers seeking to upgrade firm-level capabilities. Second, it offers researchers a methodology for assessing the efforts made by firms to improve their capabilities in the search for enhanced competitive performance.

Figure 6.3: Technological and organizational capabilities within firms

Technological and organizational capabilities within firms					
Nature of capacity building strategy and effort	**Investment**		**Production**		
	Pre-investment	Project execution	Process engineering	Product engineering	Industrial Engineering and HDR
Basic Simple routine-based mainly on internal effort and experience	Pre-feasibility and feasibility studies, site selection, scheduling, arranging finance	Routine engineering of civil works, ancillary services, erection and commissioning	Debugging plant: routine process coordination; quality management; routine maintenance; process quality certification	Assimilation of basic product design; product quality management and certification; minor adaptations to meet market needs	Workflow scheduling; time/motion studies; innovative management and optimization; skill upgrading and training
Intermediate Adaptive, duplicative: based on search, experimentation and inter-firm and other cooperation	Search for sources of technology, equipment. Contract negotiation	Equipment procurement, detailed engineering, staff recruitment and training	Capacity stretching; adapt/improve technology; use new techniques (JIT, TQM, etc.); routinized process engineering; preventive maintenance	Product quality/ design improvement; licensing new technology; reverse engineering; continuous monitoring of global technologies	Continuous and systematic productivity analysis and benchmarking; skill audit and formalized training; supply chain/ logistics management; advanced inventory control
Advanced Innovative, risky: based on purposive effort, R&D and advanced forms of collaboration	Own project outline and design capability. World class project management capabilities	Basic process engineering, equipment design and start up Turnkey capability	Continuous process improvement; process innovation; basic research; use of new process design methods. Organizational capacity for generating, codifying socializing knowledge	Mastery of product design methods; new product innovation; basic research. Strategic alliances. Organizational capacity for innovation and risk taking	World-class industrial engineering and supply chain capabilities, training systems, inventory management

Source: UNIDO, 2003a, p. 96

Note: HRD is human resources development. This is only an illustrative list of capabilities within a manufacturing firm. It does not include several types of capability, such as financial management, labour relations, and logistics

Notwithstanding these steps taken by firms to improve their capabilities, firms increasingly no longer operate as isolated actors. The fracturing of value chains and the growing complexity of technology means that firms have to act as interconnected entities if they are to enhance their competitive performance. So, how could the firms maximize the benefits of linking with other parties? Here the 2002-2003 IDR offered an important framework, identifying three sets of actions which maximized synergies with external parties. These are activities promoting linking, leveraging and learning (Box 6.3).

BOX 6.3: CAPABILITY BUILDING IN THE INTERACTION WITH EXTERNAL PARTNERS

- *Linking* involves connecting with outsiders (domestic or foreign) to acquire needed technologies and skills.
- *Leveraging* requires going beyond arms-length transactions to squeeze as much as possible from the new relationships with those outsiders.
- *Learning* involves making the many efforts to master process and product technologies, consciously building the foundation for improving current technologies and creating new ones.

Intensive and extensive growth

Economic growth can arise from a combination of three main related factors. Bringing more inputs into the process of production – more machinery, more labour and more land and other natural resources – is the first of these growth-contributing factors. This is referred to as extensive growth. Changing the quality of these inputs – improved machinery, more skilled labour, better management practices and higher yielding land – represents a second major source of economic growth. A third growth driver is an increase in the value of output, that is, rising prices.

Many developing economies gained from rising prices during the commodities price boom of 2002-2013. However, this increase in prices was mainly beyond the control of individual countries and it was transitory; the prices of many commodities have fallen back sharply since 2013. Intensive growth arising through innovation and productivity change has historically been the primary driver of economic growth since the industrial revolution's origins. Indeed, as argued during the period of UNIDO's establishment, one of the primary factors promoting industrialization is that productivity growth in manufacturing has historically been much higher than in agriculture and services.

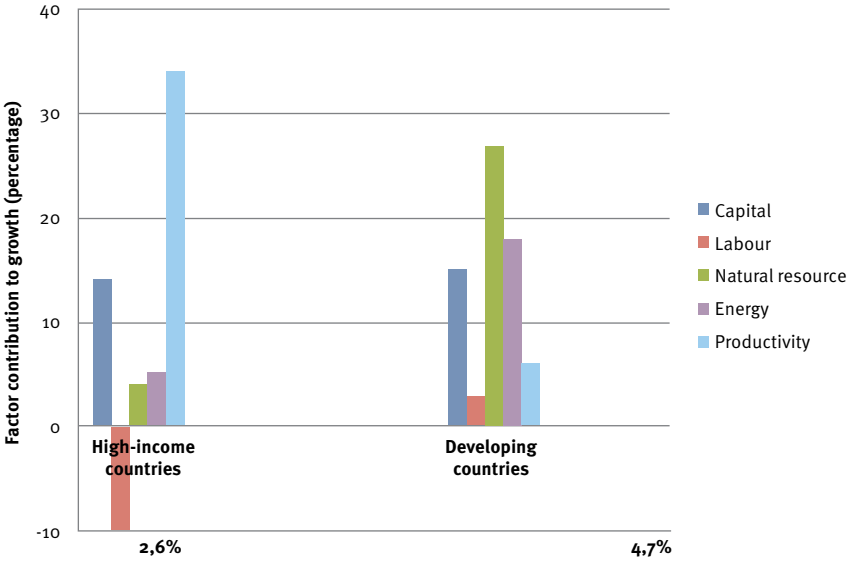
As shown in Chapter 4, during the 1970s and 1980s, the rate of productivity growth (measured by total factor productivity) fell in a group of 32 least developed countries. This happened to the extent that, if there was economic growth, it was only achieved by bringing more input into production. UNIDO's 2016 Industrial Development Report has undertaken a more recent study of the contributions of various elements of extensive growth (capital, labour resources and energy) and intensive growth (through productivity change) between 1995 and 2007. Although output growth was higher in the developing economies over this period (average output growth is shown at the top of Figure 6.4) there was a sharp divergence in the sources of growth between these two sets of economies. The high-income group had high rates of fixed capital investment (similar to that in the developing countries), but very high relative rates of productivity. By contrast, the primary sources of growth in the developing economies were high relative increases in the input of natural and energy resources and labour; productivity growth was low.

The combination of these historic and recent results on the sources of growth arising from these two sets of UNIDO studies confirms the importance of technology and capabilities as key drivers of sustainable industrial growth.

6.7. A heuristic and taxonomic contribution to knowledge: new indicators of capabilities

Many of the core concepts and associated measures concerning industrial development were developed and matured during decades leading up to the Millennium. Such measures related to gross output, net output (that is, manufacturing value added, which subtracts the cost of inputs from the value of output), trade, and R&D. These measures continue to be of considerable value in the analysis of growth and industrial development. For example, the distinction between gross output and MVA is important in reflecting the changing character of global industrial specialization and trade.

Figure 6.4: Annual average manufacturing growth and factor contributions, high-income and developing countries, 1995-2007



The analysis covers 40 countries. Based on income, eight are developing countries and the rest are high -income.

Source: UNIDO, 2016, p.39

But, as we saw in Chapter 2, there remain important deficiencies in our ability to measure some of the major determinants of growth. For example, existing measures of trade fail to record the significance of fracturing global value chains (leading to a 28 per cent over-estimation of the value of global trade). Another problem faced by researchers is that measurement categories developed for different purposes do not overlap neatly. This is particularly true for the measurement of global production (where the ISIC codes measure processes) and the measurement of trade (where the SITC codes measure product characteristics). At the end of the twentieth century, these problems were particularly acute with respect to measurements, which reflected capabilities and innovation.

The 2002-2003 IDR made practical contributions to systematize and use relevant ideas of the period to fill two of these category gaps. The first was with respect to measuring the technology intensity of production where four categories of sectors were identified (Box 6.4 and Table 6.1). The second set of capability-reflecting categories measures the technology intensity of trade (Table 6.2). Unfortunately, the two sets of categories (ISIC and SITC) do not correspond well with each other in some respects, but this is a

well-known phenomenon affecting the analysis of production and trade and reflecting historical processes of category definition.

BOX 6.4: THE TECHNOLOGICAL INTENSITY OF PRODUCTION

- **Resource-based manufactures:** mainly processed foods and tobacco, simple wood products, refined petroleum products, dyes, leather (not leather products), precious stones and organic chemicals. The products can be simple and labour-intensive (simple food or leather processing) or intensive in capital, scale and skills (petroleum refining or modern processed foods). Competitive advantage in these products generally— but not always—arises from the local availability of natural resources.

- **Low-tech manufactures:** mainly textiles, garments, footwear, other leather products, toys, simple metal and plastic products, furniture and glassware. These products tend to have stable, well-diffused technologies largely embodied in capital equipment, with low R&D expenditures and skill requirements and low economies of scale. Labour costs tend to be a major element of cost, and the products tend to be undifferentiated, at least at the mass-produced (non-fashion) end of the scale. Barriers to entry are relatively low; competitive advantages in these products—of interest to developing countries—come from price rather than quality or brand names.

- **Medium-tech manufactures:** heavy industry products such as automobiles, industrial chemicals, machinery and relatively standard electrical and electronic products. The products tend to have complex but not fast-changing technologies, with moderate levels of R&D expenditures but advanced engineering and design skills and large scales of production. In engineering products, there is emphasis on product design and development capabilities as well as extensive supplier and subcontractor networks. Barriers to entry tend to be high because of capital requirements and strong learning effects in operation, design and (for some products) product differentiation. Innovation and learning in the engineering segment increasingly involves cooperation in the value chain between manufacturers, suppliers and sometimes customers (for large items of equipment).

- **High-tech manufactures:** complex electrical and electronic (including telecommunications) products, aerospace, precision instruments, fine

infrastructure and close interaction between firms, universities and research institutions. But many activities, particularly in electronics, have final processes with simple technologies, where low wages can be an important competitive factor. The high value-to-weight ratio (for example, electronics products have a higher unit value relative to their weight than automotive products) of these products allows segments of the value chain to be broken up and located across long distances.

Table 6.1: Technological classification of manufacturing value added according to ISIC revision 2

Type manufacturing	ISIC divisions, major groups or groups
Resource-based	31, 331, 341, 353, 354, 355, 362, 369
Low-tech	32, 332, 361, 381, 390
Medium- and high-tech	342, 351, 352, 356, 37, 38 (excl. 381)
High-tech	3522, 3852, 3832, 3845, 3849, 385

Source: UNIDO, 2003, p. 146

Table 6.2: Technological classification of exports according to SITC revision 2

Type of exports	SITC divisions, major groups or groups
Resource-based	01 (excl. 011), 023, 024, 035, 037, 046, 047,048, 056, 058, 06, 073, 098, 1 (excl.121),233, 247, 248, 25, 264, 265, 269, 323, 334,335, 4, 51, 512 (excl. 512 and 513), 52 (excl. 524), 53 (excl. 533), 551, 592, 62, 63, 641, 66 (excl. 665 and 666), 68
Low-tech	61, 642, 65 (excl. 653), 665, 666, 67 (excl.671, 672 and 678), 69, 82, 83, 84, 85, 89 (excl. 892 and 896)
Medium-tech	266, 267, 512, 513, 533, 55 (excl. 551), 56,57, 58, 59 (excl. 592), 653, 671, 672, 678,711, 713, 714, 72, 73, 74, 762, 763, 772, 773, 775, 78, 79 (excl. 792), 81, 872, 873, 88 (excl. 881), 95
High-tech	524, 54, 712, 716, 718, 75, 761, 764, 77 (excl. 772, 773 and 775), 792, 871, 874, 881

Source: UNIDO, 2003a, p. 145

6.8. Technology, employment and inequality

The most up-to-date representation of UNIDO's thinking and research on technology issues may be found in the two most recent Industrial Development Reports (UNIDO 2016 and UNIDO 2013b). They address, among other things, the issues of technology, employment and inequality, which have become particularly topical in the light of high levels of unemployment, along with rapid digital technological change facing particularly the manufacturing sector of developed countries. Higher unemployment has been accompanied by increasing inequality.

Latest UNIDO estimates of employment for 2015 based on calculations presented in the 2013 IDR suggest that there are approximately 500 million manufacturing workers, of which around 80 per cent are employed directly in production, while the remainder have found jobs in manufacturing-related services, i. e. businesses which would not have been possible without the existence of directly related manufacturing activities. While manufacturing employment in developing countries has been steadily increasing, in developed countries it has been decreasing and was particularly hit by the 2008 financial crisis. Since then there has been a slight recovery below the level of expectations, which has prompted the question of whether manufacturing employment in developed countries will ever recover, particularly with the highly disruptive labour-saving technical change.

Between 1990 and 2010 the gap between rich and poor in the OECD countries reached its highest level in 30 years, with the average income of the richest 10 per cent of being about nine times higher than that of the poorest 10 per cent (Open Working Group on Sustainable Development Goals 2014).

Countries' growth experiences in the past decades indicate that technological change may have a negative impact on jobs and equality. In terms of employment, although technology and automation generally improve people's working conditions, they may decrease the number of jobs, replacing workers with machines. Technological change also requires workers to be prepared to use increasingly complex machinery and equipment. This widens the inequality between highly skilled and unskilled workers in terms of wage distribution. Where technological change is skill-biased and the labour supply fails to keep up with the demand for skilled labour, inequality will tend to increase. However, those should not be considered inevitable outcomes.

The UNIDO IDR 2016 suggests that technological change itself can mitigate the job reduction effect, as new technologies generate new markets, reduce the prices of

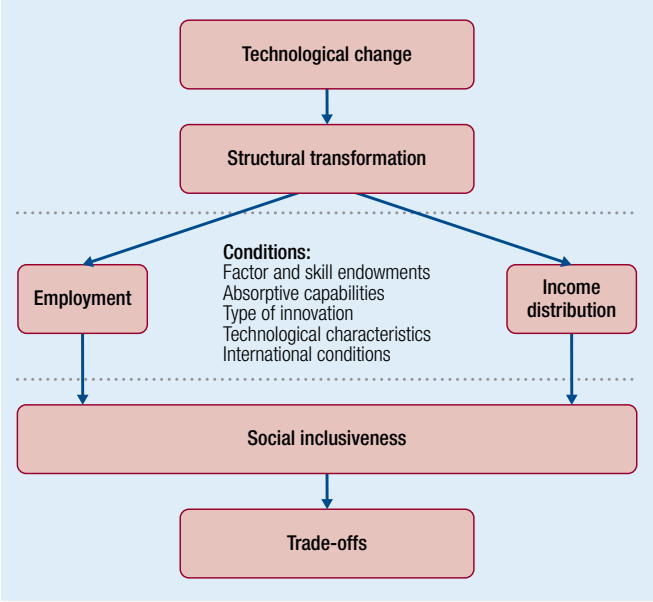
consumer goods and provide opportunities for new investments with higher levels of profitability. Moreover, the expansion of new technologically-intensive industries absorbs those workers who have lost their jobs to machines. Besides, if productivity growth goes hand in hand with accelerated growth of output, the net effects on employment can be positive. So, if structural change and industrialization promote rapid growth in the whole economy due to linkages and spillovers, this can increase total employment and labour absorption (UNIDO, 2016).

Therefore, the effect of technologies on social inclusiveness depends on the specific conditions that characterize a country (for example, factor and skills endowments and absorptive capabilities), its technological trajectory and the type of innovation. Product innovations, for example, have a positive effect on creating new jobs while process innovations have a negative impact (UNIDO, 2013b). Product innovations create new economic activities and sectors or increase the importance of existing sectors, drawing people into the labour market. Process innovation typically creates a labor-saving effect, mainly related to introducing new machines that allow the same output to be produced with fewer workers (UNIDO, 2013b). Also, if technological change is labour-saving, it will promote economic sectors that are more capital-intensive and affect the volume and structure of employment. If it is skill-based, it will increase the demand for skilled labour and reduce the demand for unskilled labour and, therefore, affect the income distribution. However, the results of those processes are not predetermined. Through labour-saving process innovation, for example, several economic forces can compensate for the reduction in employment (UNIDO, 2013b):

- New machines. The same process innovations that displace workers in the product industries where the new machines are introduced can create new jobs in the capital goods industries, where new machines are produced. Capital goods industries tend to be labour-intensive.
- Lower prices. Although innovations involve the displacement of workers, these innovations reduce the unit costs of production, and in a competitive market this lowers prices, which stimulate new demand for products and by extension additional production and employment.
- New investments. The reduction in costs—due to technological progress—and the consequent fall in prices may allow innovative entrepreneurs to accumulate extra profits. If these profits are invested well, they will create new output and new jobs.
- Lower wages. Where there is demand for labour, the direct effect of job-destructive technologies may be compensated within the labour market. Assuming free competition and full substitutability between labour and capital, technological unemployment implies a decrease in wages, and this should induce a reverse shift back to more labour-intensive technologies.

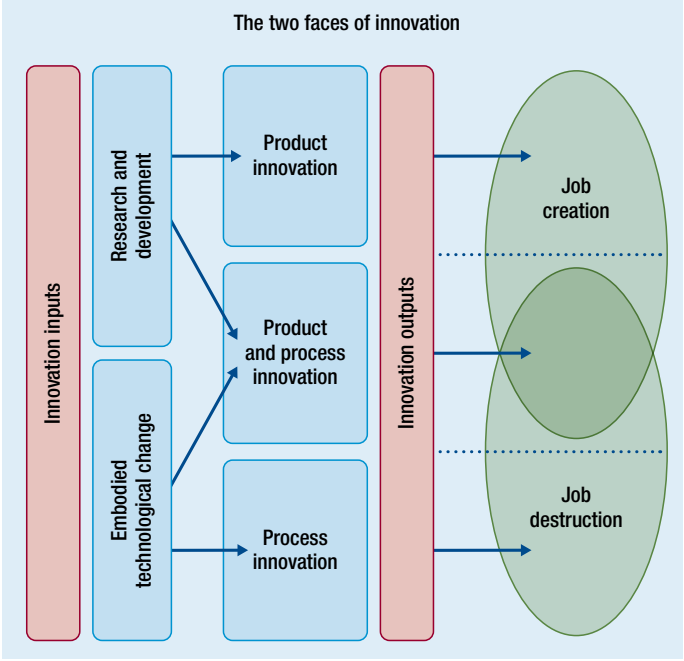
- Higher incomes. Trade unions may redistribute part of the innovation rents back to the workforce, so a portion of the cost savings due to innovation can be translated into higher wage income and thus higher consumption. This increase in demand increases employment, which may compensate for the initial job losses (UNIDO, 2013b).

Figure 6.5: Conceptual framework: technological change for inclusive structural transformation



Source: UNIDO, 2016, p.104

Figure 6.6: Innovation inputs and outputs and their impact on employment



Source: UNIDO, 2013b, p.95

The conditions within a country (market structure, investment behaviour and degree of substitution between factors) determine how well compensation mechanisms will alleviate the negative impact of labour-saving process innovations. In addition, new technologies and structural change may introduce important trade-offs between employment and other objectives. For example, new technologies that promote social inclusiveness might achieve that at the expense of environmental deterioration. Or new technologies that improve environmental sustainability might hurt job creation and income distribution.

CHAPTER 7

ANALYSING AND DOCUMENTING THE SPREAD OF LINKAGES AND GLOBAL VALUE CHAINS IN MANUFACTURING

As observed in Chapter 2, since the late 1980s GVCs have become an increasingly important component of the global industrial landscape, particularly with respect to export-oriented manufacturing. Accounting for more than two-thirds of global trade, GVCs are not only an important conduit for export earnings, but in the right circumstances they can also be a significant source of learning. GVCs play an important role in the generation of backward and forward linkages and inter-country distribution of income in manufacturing, as well as in the distribution of returns within and between firms in exporting economies.

Through its extensive involvement in delivering support for industry in low-income economies, UNIDO had its finger on the pulse of the emergence of GVCs. Together with the FAO (which was practically involved in the agricultural sector) and the International Trade Centre (which was actively involved in trade facilitation), UNIDO led the way in the United Nations system and Bretton Woods institutions in analysing and documenting the rapid evolution of interindustry linkages and GVCs, and their impact on exporting economies.

There were three strands to UNIDO's focus on GVCs. The first was the examination of linkages between sectors, particularly in the context of resource-based economies. The second was UNIDO's empirical contribution to conceptual development in the analysis of GVCs; the third was the documentation of key trends in GVCs; and the fourth was the

way in which UNIDO developed value chain (VC) stakeholder cooperation in the design and implementation of industrial policies. The first three of these contributions will be considered in this discussion; the recounting of UNIDO's use of VCs as a method of understanding the determinants of successful policy implementation will be reviewed in the industrial policy chapter.

7.1. Commodities, terms of trade and linkage-led unbalanced growth

As demonstrated in Chapter 2, one of the recurrent themes pioneered by Hans Singer, the lead intellectual in the UN Centre for Industrial Development in New York and Raul Prebisch, who later became the head of UNCTAD, was the declining commodities-manufactures terms of trade, whereby the prices of commodities were falling against the prices of manufactures. Singer, largely supported by the research and policy communities, argued that this was a powerful argument in favour of promoting industry in the developing world. This argument remains for many an uncontested policy conclusion.

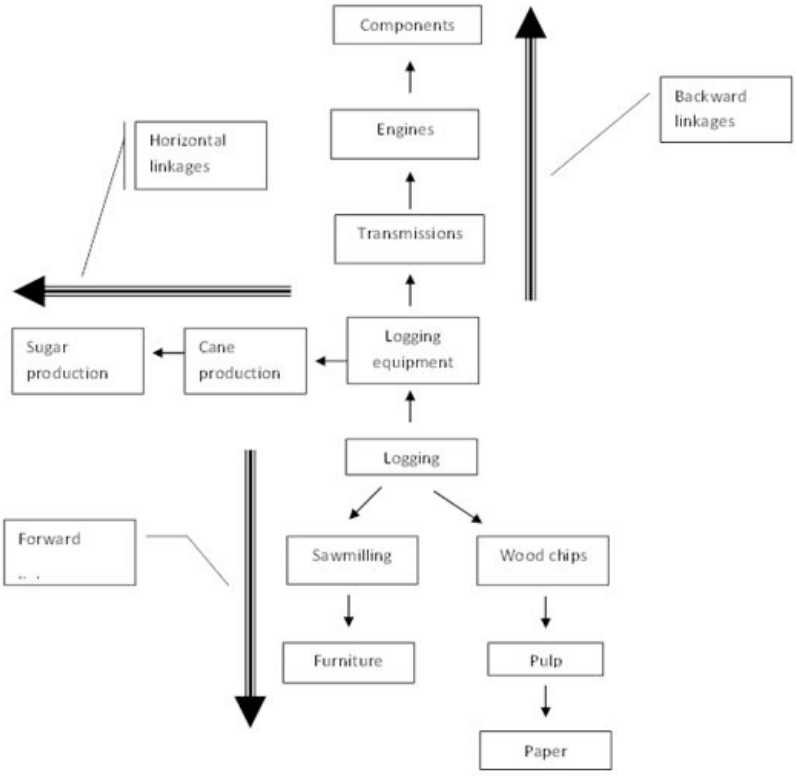
But in practical terms, what could those developing economies with substantial natural resources do? Did this mean that they should stop producing commodities? And, if so, what could substitute for the loss of employment (particularly in the case of agricultural commodities) and foreign exchange which this would involve? Here, Hirschman made an important contribution. As mentioned in Chapter 2, he argued that the commodity sectors were an important source of linkages which could and would—through a process of market linkages—foster industrial development.

Many of UNIDO's technical assistance programmes have been devoted over the decades to linking "soft" agricultural commodities and "hard" mineral, metal and hydrocarbon natural resources to industry. Recent UNIDO publications have thrown light on both different categories of linkages and the extent of linkage development, particularly in resource-dependent African economies.

Hirschman had specified three sets of linkages from the commodities sector. These were financial linkages (the use of earnings from commodities to promote industrial development in unrelated sectors), consumption linkages (the demand for local manufactures arising from incomes generated in the production of commodities) and production linkages (direct links from the commodities sectors to industry).

UNIDO publications, drawing on in-depth research by their African collaborators, illustrate three sets of production linkages (see Figure 7.1 for an example from the wood and timber sector). The first are backward, upstream linkages supplying inputs to the commodities sector. The second are forward, downstream linkages utilizing the outputs of the commodities sector (distinguishing raw-material processing such as smelting from "beneficiation", the conversion of raw materials into intermediate and final manufactured products). The third set of linkages are horizontal linkages, in which capabilities developed to meet the needs of a specific sector are applied in other sectors.

Figure 7.1: Backward, forward and horizontal linkages in the wood and timber sector



Source: UNIDO, 2012, p.43

There has been widespread skepticism of the extent of linkages from the commodities sectors, based in part on the dismissal by Singer and others in the 1950s and 1960s of the potential for linkage-led growth in developing economies. However, in the years of intervening, some of the constraints to linkage-led industrial growth were reduced, notably the advance of skills and technological capabilities in many developing economies, and the wish by many lead-mining and other resource firms to promote local linkages. In this, the lead resource firms have been late followers of the outsourcing strategies which have driven the development of Global Value Chains in the manufacturing sector since the mid-1980s (see Chapters 2 and 8). The protracted commodity price boom between 2002 and 2013 gave further impetus to the desire to promote linkage-led development.

Table 7.1 shows the results of research in nine African economies on the nature and extent of linkages from the commodities sector. It distinguishes between different types of linkages (backward, forward and horizontal), the extent of linkages in terms of different types of products and services (the breadth of linkages), and the degree of value added in these linkages (depth of linkages). It further reflects on the maturity of these commodity investments (when exploitation started), and the gap between the technological needs of these sectors and local capabilities. Finally, it offers a judgment on the trajectory of linkage development. The evidence presented supports Hirschman's conclusion that in many circumstances, linkages from the resource sector can indeed be a driver of industrial development. However, although market forces play an important role in linkage development, they extend optimally through support from governments.

The ideas of the big push, the declining terms of trade and unbalanced linkage-led growth developed during the 1940s, 1950s and 1960s were widely seen as competing paradigms. The big push and the recognition of the declining terms of trade suggested promoting industry at the cost of the promotion of the commodity sectors. Yet, fifty years after the establishment of UNIDO the picture looks more complex. The world witnessed important transformation of the terms of trade within manufacturers since early 1990s and an extended commodity price boom for more than a decade after 2002. Hence, in the contemporary world, ideas of the big push and commodity-based linkages in industrial development should no longer be seen as competing paradigms. This recognition is central to the project work which UNIDO undertakes in its core technical assistance activities in the developing world.

Table 7.1: The summary of findings on the breadth, depth and trajectory in linkages from commodities to other sectors in eight SSA economies

Country	Sector	Linkage type	Breadth of linkage	Depth of linkage	Horizontal linkages	Maturity of the Commodity Sector	Gap between capabilities, sectoral complexity and capital cost	Trajectory of linkages
Angola	Offshore oil	Backward	Thin	Thin (labour only)	None	Mid 1990s	Complex and capital intensive sector vs low domestic capabilities	Increasing depth
Botswana	Diamonds	Forward	Thin	Thin (largely labour)	None	1960s	Craft intensive processing and weak skills	Increasing breadth and depth
Gabon	Timber	Forward	Thick	Transformation of commodities	None	Early 1960s	Capital intensive processing, weak skill and supplier base	Resistance to shallowing
Ghana	Gold	Backward	Beyond thin	Some transformation of inputs, and knowledge intensive services	Not fully known, but probable	late 19th Century	Capital intensive processing, moderate skill base	Increasing breadth and depth
Nigeria	Oil	Backward	Approaching thick	Knowledge intensive services	Not fully known, but probable	1950s	Capital intensive processing, improving skill base	Increasing breadth and depth
South Africa	Mining capital equipment and specialist services	Backward	Thick	Transformation of inputs, and considerable knowledge intensive services	Substantial	1880s	Knowledge and capital intensive, well developed industrial skill and knowledge base	Becoming shallower?
Tanzania	Gold	Backward	Thin	Thin	Unlikely	1998	Capital intensive processing, weak skill base	Static
Zambia	Copper	Backward	Approaching thick, but diminishing	Approaching thick transformation of inputs and outputs, but diminishing backward linkages	Not known, but probable	Early 20th Century	Capital intensive processing, moderate industrial base	Shallowing

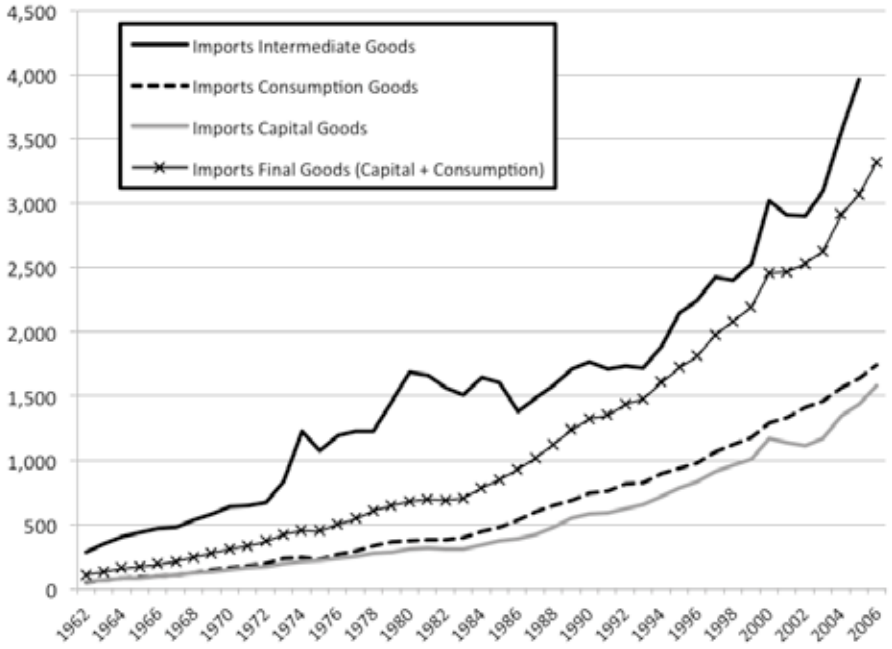
Source: Farooki, 2012

7.2. Empirical contribution to the development of theory

One of the key elements in the development and expansion of GVCs has been the increasingly fine division of labour (Chapter 2). Consequently, a growing share of global trade occurs in intermediate products. This poses a major challenge to the use of accepted measures of trade (and production): as we mentioned, recent estimates show that 28 per cent of the total value of global trade is double-counted. As already mentioned, intermediate products such as mobile phone screens are counted twice; as exports from Korea where they are made and part of the final product—mobile phones—exported from the assembling economy (predominantly China). Similarly, most intermediates are themselves made of intermediates, and these too will often have crossed global borders, contributing to the inflation of global trade values.

But how is this trade in intermediates to be measured? UNIDO's early research on this subject drew on a seldom-used classification in the UN COMTRADE database, which distinguished between three end-use categories for traded goods — capital goods, intermediate goods and consumption goods. Figure 7.2 shows the rapid rise of trade in intermediate goods, particularly after the late 1980s when China entered the global economy as a significant exporter of manufactures. It also shows that trade in intermediates is much more volatile than that in capital goods or goods for final consumption. The explanation of this volatility (based on qualitative research in the electronics sector) is that during periods of demand recession, the leading companies in GVCs tend to draw down their stocks and then to rapidly ramp-up production in subcontractors when final demand revives.

Figure 7.2: World imports of intermediate, capital and consumption goods 1962-2006, in billions of constant US Dollars (2000)



Source: Sturgeon and Mehmedovic, 2011, p.8

The rate of growth in the exports of intermediate manufactures was, as shown in Table 7.2, much higher in the developing world (9.2 per cent between 1992 and 2006) than in the industrialized economies (5.7 per cent during the same period). Although the economies of the Commonwealth of Independent States (CIS) saw a rapid growth in trade in intermediate manufactures, their share in the global trade remained very small (1.6 per cent in 2006). By contrast, the share of the developing world in the global trade in intermediate manufactures rose from 25.5 per cent in 1992 to 35.2 per cent in 2006.

Table 7.2: Developing countries' rising share of total trade (imports plus exports) in manufactured intermediate goods, 1992- 2006

Shares	1992	1995	2001	2006
Industrialized	72,2%	71,5%	70,5%	63,2%
Developing	25,5%	21,7%	27,5%	35,2%
CIS	0.8%	1,1%	1,7%	1,6%
Unclassified	1,5%	0,3%	0,2%	0,0%
Growth rates	**CAGR 992-2006**	**CAGR 1992-1999**	**CAGR 2000-2006**	**CAGR 2001-2005**
Industrialized	5.7%	5.5%	4.3%	4.7%
Developing	9.2%	6.5%	10.6%	14.5%
CIS	12.1%	19.1%	4.7%	7.7%
Not-classified	-18.2%	-18.0%	-24.5%	-1.1%

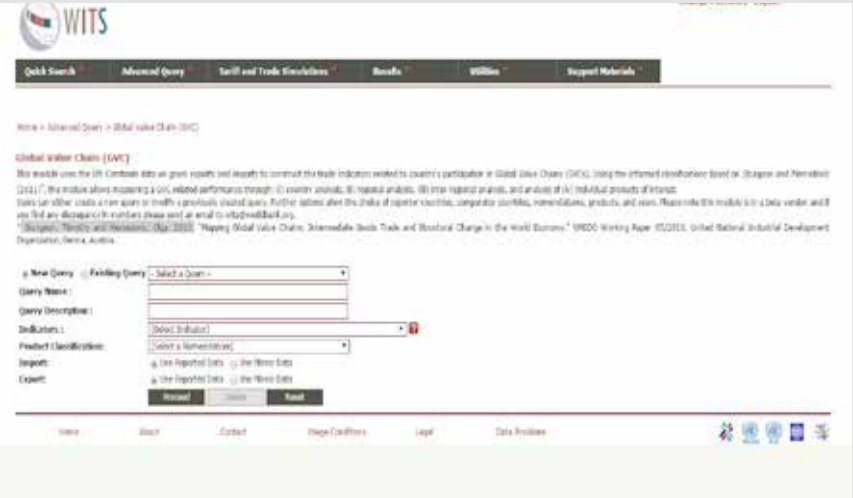
Table based on UN COMTRADE SITC Rev. 1 data. To identify commodities as Consumption, Capital and Intermediate goods, the conversion table BEC to SITC Rev. 1 from WTS has been used. In order to calculate constant price data, National Accounts data from UNIDO Statistics UNIT and GDP deflator has been applied.

Source: Sturgeon and Mehmedovic, 2011, p. 8

However, as the UNIDO contribution went on to show, the pattern of trade in intermediates was more prominent in some sectors (such as electronics and, to a lesser extent automobiles) than others (such as apparel and footwear), reflecting the greater technological complexity of intermediate-intensive sectors and the fact that these sectors involved the assembly of a multitude of intermediate components, many of which leant themselves to subcontracted production in low-wage economies. This led the UNIDO team to draw a distinction between standardized intermediates (such as many resource-intensive manufactures) and customized intermediates. These insights into the magnitude and complexity of the GVC-led trade in intermediates made an important contribution to the evolving analysis of trade in intermediates conducted subsequently by the OECD, WTO, World Bank and national statistical agencies such as the International Trade Commission in the USA (Box 7.1).

BOX 7.1: A TOOL FOR MEASURING TRADE IN INTERMEDIATES AS AN INDICATOR OF THE SPREAD OF GVCS

The World Bank — in collaboration with the United Nations Conference on Trade and Development (UNCTAD) and in consultation with organizations such as International Trade Center, United Nations Statistical Division (UNSD) and the World Trade Organization (WTO) — developed the World Integrated Trade Solution (WITS). The tool used to map trade in intermediate products as an indicator of the spread of GVCs uses the concepts and material provided by UNIDO:



A second contribution made by UNIDO related to the analysis of upgrading in GVCs. As shown in Chapter 2 the growing complexity of competition in the global economy after the mid-1970s pushed the innovation frontier from a focus on cost- and price-reduction to a growing concentration on product innovation, particularly in relation to the innovation of higher-value-added products. But how was this pattern of product innovation to be measured? True, higher quality products involved higher prices, but how are price increases reflecting product quality to be distinguished from price increases resulting from inefficient production?

An analysis by UNIDO of trade patterns in the global wood furniture industry combined price-performance with the share of global trade. Four sets of economic performance were identified (Figure 7.3). Economies in the north-east Quadrant 1 (rising relative prices and falling market shares) were judged to have failed in product upgrading. Economies which increased prices and market shares (Quadrant 2) were successful product upgraders. Economies with falling market share and falling prices (Quadrant 3) were deemed to have failed at both process and product innovation, while the economies whose market share had risen with falling prices were judged to have succeeded in process innovation (Quadrant 4).

This taxonomy was then applied to assess global trade in wood products by analysing the prices and market shares of all countries exporting wood products to the EU at the highest level of product disaggregation available (the eight-digit HS level) between 1988 and 2001. This showed the complexity of upgrading performance — some economies with diversified furniture industries were represented in more than one of the four upgrading quadrants. The use of this taxonomic schema was widely used in subsequent research by a community of scholars focusing on the extent to which there are trade-offs between social and economic efficiency of GVCs (www.capturingthegains.com).

Figure 7.3: The taxonomy for measuring process and product upgrading in GVCs

	MARKET SHARE DECREASES	MARKET SHARE INCREASES
UNIT VALUE RISES RELATIVE TO INDUSTRY AVERAGE	Quadrant 1 Failed product upgrading	Quadrant 2 Product upgrading
UNIT VALUE FALLS RELATIVE TO INDUSTRY AVERAGE	Quadrant 3 Product and process downgrading	Quadrant 4 Process Competitiveness

Source: Kaplinsky and Readman, 2001, p.8

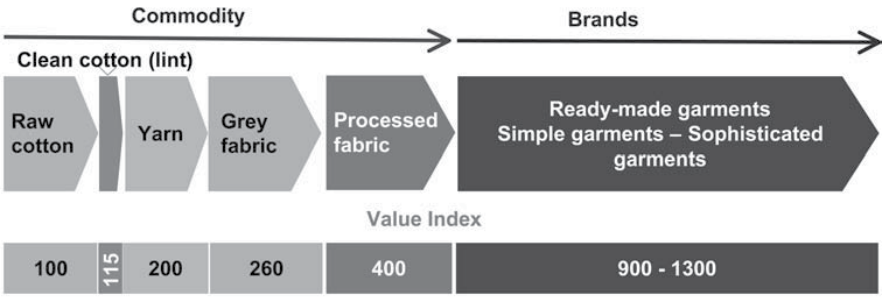
7.3. Documenting trends in the diffusion of GVCs

By their nature GVCs are complex and heterogeneous entities. They vary across time, space, sector and sub sector. Since the essence of UNIDO's activities is working with the productive sector, it is not surprising that there are many stories to be told about the functioning and dynamics of GVCs which are embedded in a large variety of UNIDO reports. Below we summarized selected insights from these reports to portray major trends in GVCs.

Mapping the chain

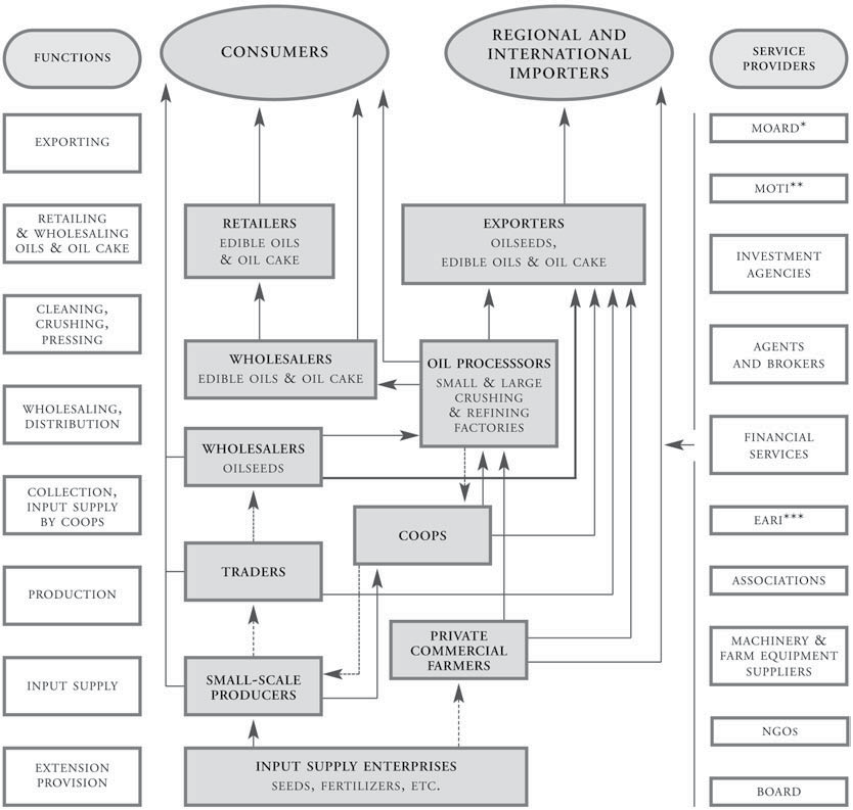
One of the first tasks in any analysis of value chains is to map the chain. As shown in Chapter 3, a value chain comprises a whole range of activities required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use. How do these chains look in practice, given their heterogeneity? The answer depends on the level of analysis. It may be blunt and contain little detail (Figure 7.4 on the textile and apparel chain), or be more elaborate, specifying a range of tasks, stakeholders and customers as in the oilseeds chain in Ethiopia (Figure 7.5). UNIDO documentation is replete with different value chain maps, spanning sectors, details and economies, and these have been widely used by researchers and policymakers in a wide variety of contexts.

Figure 7.4: The textile and apparel value chain – a schematic view



Source: UNIDO 2009a, p. 27

Figure 7.5: The oilseeds value chain in Ethiopia: activities, stakeholders and customers



Source: UNIDO, 2009a, p. 19

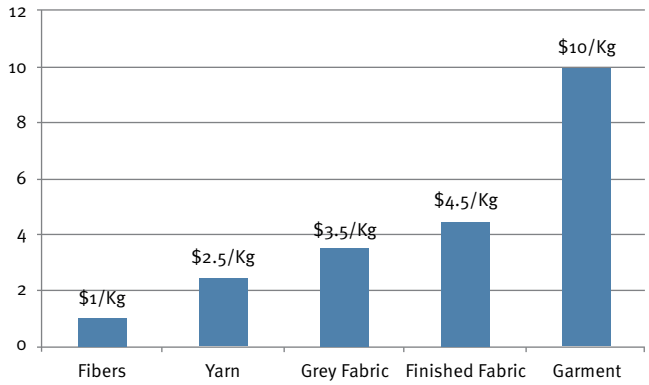
The build-up of value along the chain

A second issue recorded in UNIDO's research on GVCs related to the accretion of value added in the chain. Which links in the chain commanded the highest share of final product prices, and where were these activities located in the global distribution of value addition? Again, as in the case of value chain mapping, the degree of detail varied across GVC studies. Figure 7.6 provides a snapshot of the major categories of

activities in the cotton textile and apparel value chain. It shows that more than a half of this value added is captured in the apparel manufacturing link.

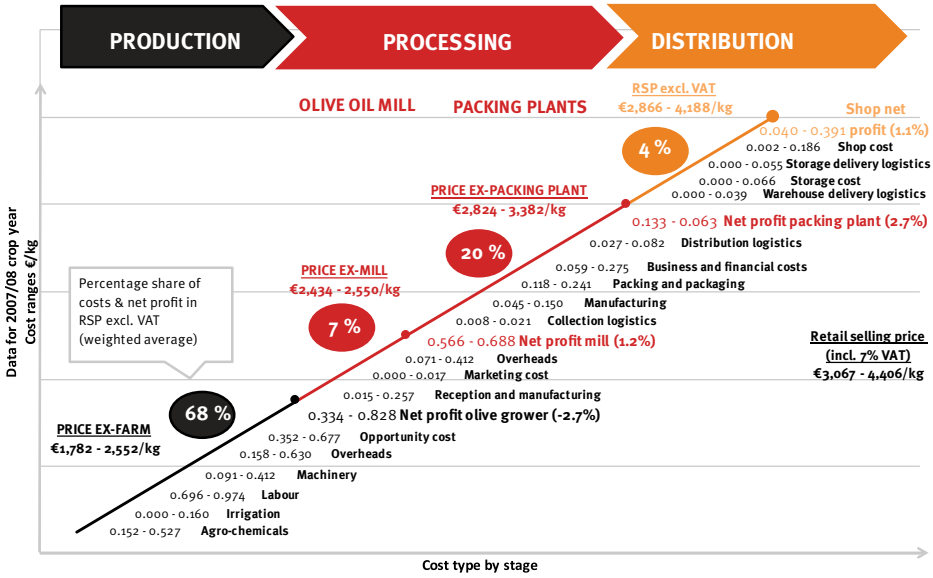
Other UNIDO reports provide considerably more detail on the accretion of value across a chain. Figure 7.7 analyses the accretion of value across the Spanish virgin olive oil value chain, distinguishing three broad categories: agricultural production, industrial processing and distribution. It shows that the industrial links in this chain receive 27 per cent of the product's final selling price; most of the value (68 per cent) is captured in the agricultural sector, in contrast to the cotton apparel value chain (Figure 7.6) where the share of the agricultural sector is around 20 per cent of the final selling price.

Figure 7.6: The build-up of product price in the cotton textile and apparel value chain



Source: Gherzi Research, 2005

Figure 7.7: Prices, margins and value added in the Spanish extra virgin olive oil value chain



Source: UNIDO, 2015b, p.53

The determination of rents along the chain

The share of final value generated individual links of the chain only carries the analysis thus far. It says little about the incomes generated in the chain. Some links may generate a small share of the total final product value (for example, advertising), but this share may be distributed between a relatively small number of parties. Conversely, a large proportion of total product value (for example, generated in cotton production) may have to be shared between many thousands of small farmers.

Very few academic and policy studies on GVCs provide numerical data of this nature. Instead, qualitative analyses of GVCs tend to address the related themes of buyer-power in the final markets and the capacity of producers to innovate and upgrade their offerings. Both these trends show in the global apparel industry. A UNIDO 2003 study (Gereffi and Memedovic) focused on three types of chain feeding into the US and EU final markets – garment assembly, OEM subcontracting and OBM branded manufacturing:

- **Assembly** is a form of industrial subcontracting, in which garment-sewing plants are provided with imported inputs for assembly, most commonly in export processing zones (EPZs).
- **Original equipment manufacturing (OEM)** is a form of commercial subcontracting. The supplying firm makes a product designed by the buyer; the product is sold under the buyer's brand name; the supplier and buyer are separate firms; and the buyer lacks control over distribution.
- **Original brand name manufacturing (OBM)** is the upgrading by manufacturers from the productions expertise of OEM to designing and selling their own brand products.

Assembly plants, mainly located in Mexican, Central American and Caribbean export processing zones (for the US) and in North Africa (for the EU), were predominantly involved in labour-intensive assembly. This explained the low level of wages in the producing countries. OEM manufacture built various levels of linkages in the source countries, and engaged in so-called full-package production. The resulting value added and generated incomes in the source countries were higher than those in the thin-value added assembly operations. However, they were still lower than the incomes including a share of the design rents and marketing apparel under their own brand names. Generally, the OEM and OBM chains in this sector were located in East Asia, although in many sub sectors Mexico started to pursue full-package production. This and other UNIDO studies on GVCs also showed the important role that trade agreements played in this evolving division of labour. Rules on entering the US market from the Caribbean and Mexico prohibited the use of non-US and extra-regional inputs, reducing the capacity of assembling firms to deepen their share of value added in the chain. Similar developments assisted the incorporation of North African and sub-Sahara African suppliers into the EU and US markets.

The role of buyers in determining the capacity of developing economy producers to upgrade

A critical factor in the ability of producers to upgrade is the manner in which they are connected to final markets. In the apparel sector of the early 2000s, retail and marketing firms in the importing economies tended to utilize OEM full-package suppliers, predominantly located in East Asia where industrial capabilities are most fully developed. By contrast, brand name buyers were most likely to draw on sub-contracted assembly plants in export processing zones, supplying the producers with inputs, and capturing most of the higher incomes in the chains.

The "rents" (or higher incomes) are distributed along these chains based on a

combination of the relative power of buyers, and the industrial capabilities of suppliers. Across most sectors, buying in final markets is highly concentrated. The UNIDO study of apparel reported that between 1987 and 1991, the five largest soft goods chains in the United States increased their share of the national apparel market from 35 to 45 per cent. By 1995, the five largest retailers—Wall-Mart, Sears, Kmart, Dayton Hudson Corporation and JC Penney—accounted for 68 per cent of all apparel sales. The next top 24 retailers, all billion-dollar corporations, represented an additional 30 per cent of these sales. Thus, the 29 biggest retailers made up 98 per cent of all United States' apparel sales. The two top discount giants, Wall-Mart and Kmart, controlled one quarter of all apparel (by unit volume, not value) sold in the United States by the turn of the century.

Thus the issue of retaining incomes in the chain involves the balance struck between the concentrated buying power and the capacity of producers to upgrade their capabilities. One of the common themes emerging from many GVC studies is the high entry barriers, especially in labour-intensive sectors, hindering "functional upgrading", i.e. developing capabilities in design, branding and marketing. Positioned between these two extremes is the capacity to introduce product innovations. Figure 7.8, based on UNIDO's work in supporting GVCs, distinguishes different sub-categories of upgrading in GVCs.

Figure 7.8: Different categories of upgrading in GVCs and indicators for their measurement

	Process upgrading	Product upgrading	Functional upgrading
Form of upgrading	Improving production efficiency	Making a product that is of better quality or more sophisticated Introducing new products	Shifting to new links in the chain and/or abandoning links of past specialization
Examples of Indicators of progress	• Investment in machinery • Work force training • Changing layout • New management techniques • Introduction of total quality programmes • Socially and environmentally sound practices	• New models • New lines • Higher prices	• Design own products • Brand own brands • developing own chain of shops

Source: Adapted from UNIDO, 2001b, p.65

A UNIDO study of the wooden furniture industry illustrates how the capacity of producers to achieve product and functional upgrading was affected by the nature of the final buyers (Figure 7.9). It distinguished between the location of activities along the chain (in high-income buying economies or low-income source economies) and the extent to which suppliers were encouraged/allowed to perform different upgrading activities in the chain. Producers in this chain were left with the choice of relatively low volumes and higher shares of product value and producing large volumes but having to compete with low-wage mass producing suppliers across a range of developing economies.

Figure 7.9: What activities do different UK buyers outsource to various types of economies?

Activity	Multi-store retailer		One/ limited-store retailer		Importing agent	
	High wage economies	*Low wage economies*	*High wage economies*	*Low wage economies*	*High wage economies*	*Low wage economies*
After sales service						
Retailing						
Distribution						
Marketing						
Design						
Purchasing						
International transport						
Production						

Black represents predominant reliance, grey — partial reliance, and blank — no reliance on firms from these groups of countries

Source: Kaplinsky and Readman, 2001, p.6

Capability building in GVCs

One of the major virtues of the value chain framework is that it highlights the importance of systemic efficiency. Production is traced along the chain, backwards to suppliers and forwards to user firms. Hence of capability building and distribution of returns in the chain can be analysed in a wide remit, involving small firms and even informal sector producers.

Many of the UNIDO GVC studies track these developments (to varying degrees determined by the sector and the depth of the study). One of the sectors in which UNIDO GVC analysis was especially fruitful was the automobile value chain, focusing particularly on the manner in which different types of suppliers were incorporated across the chain and on their activities. The study showed that in this key industrial sector, the complexity of operations meant that the major assemblers devolved much of the innovative effort to global mega-suppliers, who in turn drew on first-tier suppliers (Box 7.2). In most cases assemblers required these first-tier suppliers to "follow" their operations and locate near their global plants. This combination of "global sourcing" and "follower supply" limited the role of locally-owned firms confined to be second- and third-tier suppliers.

BOX 7.2: CAPABILITY REQUIREMENTS IN THE GLOBAL AUTO INDUSTRY

Assemblers. Increasing scale required to spread costs of vehicle design and branding. Innovation and design capabilities remain critical as first movers in new markets sections can gain important rents while other companies catch up. Some companies, such as Ford, appear to believe that core competences lie more in branding and finance, and they are outsourcing parts of manufacturing. Others, such as Toyota, maintain an emphasis on manufacturing excellence and competence.

Global mega-suppliers. These firms supply major systems to the assemblers. They are sometimes referred to as "Tier 0.5" suppliers, because they are closer to the assemblers than the first-tier suppliers (see below). These companies need to have global coverage, in order to follow their customers to various locations around the world. They need design and innovation capabilities in order to provide "black-box" solutions for the requirements of their customers. Black-box solutions are solutions created by the suppliers using their own technology to meet the performance and interface requirements set by assemblers.

First-tier suppliers. These are firms, which supply direct to the assemblers. Some of these suppliers have evolved into global mega-suppliers. First-tier suppliers require design and innovation capabilities, but their global reach may be more limited.

Second-tier suppliers. These firms will often work to designs provided by assemblers or global megasuppliers. They require process-engineering skills in order to meet cost and flexibility requirements. In addition, the ability to meet quality requirements and obtain quality certification (ISO9000 and increasingly QS9000) is essential for remaining in the market. These firms may supply just one market, but there is some evidence of increasing internationalization.

Third-tier suppliers. These firms supply basic products. In most cases, only rudimentary engineering skills are required. A study by Leite (1997) of skills and training at different parts of the automotive value chain in Brazil showed that in the third-tier of the component chain, skill levels and investments in training were limited. At this point in the chain, firms compete predominantly on price.

Aftermarket. A further important segment of the automotive value chain is the market for replacement parts. This is the sector that many firms in developing countries first moved into, even before local assembly sectors were developed. Nowadays, there is an international trade in aftermarket products. Firms in this section compete predominantly on price. Access to cheaper raw materials and process engineering skills is important. Innovation is not required because designs are copied from the existing components, but reverse engineering capability and competence to translate designs into detailed drawings are important.

Source: Humphrey and Memedovic, 2003

These and other related developments were explored in a UNIDO study on the South African auto value chain. Among other things, this study showed the importance of intelligent policy design. Given its relatively small domestic market and its distance from global markets, nobody anticipated that the South African industry in 2015 would produce more than 650,000 vehicles (approximately a half of which were exported) and employ more than 75,000 people. The study also showed how the development of global sourcing and follower supplier supplanted domestic ownership in the supply chain – between 1997 and 2003, the share of component purchases coming from locally-owned firms fell from 25.8 to 10 per cent (Table 7.3).

Table 7.3: Ownership status of, and the technology used by, SA-based component manufacturers supplying SA-based assemblers (n=4) (% of OEM purchase value)

Category	1997	2000	2003
Wholly owned subsidiaries of MNC automotive component manufacturers	26%	31.7%	37.5%
Joint ventures between SA companies and MNC automotive component manufacturers	18.5%	26%	32.5%
SA companies with technology agreements with MNC automotive component manufacturers	29.8%	24.3%	20%
SA companies with South African technologies	25.8%	18%	10%
Total	100%	100%	100%

Source: Barnes and Morris, 2005

The change in focus from the firm to the chain of firms which arises from the application of the GVC framework is not just an analytical device useful to explain the inter-country and intra-sectoral distribution of incomes and activities. Through supply chain development programmes, it can also be a powerful vehicle for systemic efficiency improvements. As a UNIDO study documented, the surprising success of the South African auto sector can in part be traced back to concerted attempts to improve efficiency amongst suppliers. Supported initially by the government and then funded by the private sector itself, a "Benchmarking Club" was established across the value chain, initially comparing performance across domestic suppliers and subsequently with suppliers in both high-income and emerging economies. This benchmarking was used to spur improvements in lean manufacturing, resulting in substantial improvements across a large number of suppliers in the auto sector (Table 7.4), and subsequently in other sectors: textiles and apparel, retailing and chemicals.

Table 7.4: Operational performance change of firms in clubs (2001-2004)

Market Drivers	Key Performance Indicators	n	South African Firms			Comparator Firms			
			2001	2004	*Change 2001-4*	Developed Economies		Emerging Economies	
Cost Control	Raw materials (days)	55	23.26	20.50	*11.9%*	12	11.42	43	18.83
	Work in progress (days)	55	7.10	6.92	*2.6%*	12	6.40	43	7.18
	Finished goods (days)	55	12.25	10.41	*15.0%*	12	8.17	43	9.33
	Total inventory (days)	55	42.61	37.83	*11.2%*	12	26.03	43	35.90
Quality	Customer return rate (ppm)	43	1,558	276	*82.3%*	11	266	34	1,127
	Internal reject rate (%)	38	3.87	3.26	*15.8%*	12	1.44	47	1.73
	Internal scrap rate (%)	41	1.98	1.74	*12.1%*	11	2.14	34	1.90
	Internal rework rate (%)	39	2.76	2.79	*-1.05%*	8	0.32	14	1.51
	Supplier return rate (ppm)	41	16,330	11,645	*28.7%*	8	7,470	34	9,506
Flexibility	Lead time ex production domestic (days)	50	8.50	7.69	*9.6%*	7	7.57	18	4.57
	Lead time ex production international (days)	29	43.63	43.54	*0.2%*	6	7.83	8	27.94
	Supplier on time (%)	50	86.25	88.41	*2.5%*	13	93.88	47	89.19
	On time to customers (%)	53	91.25	93.21	*2.1%*	14	97.66	48	93.69
Capacity to change	Training spend as % total remuneration	53	2.06	1.95	*-5.3%*	11	2.05	34	4.39
	Absenteeism (%)	57	4.14	3.57	*13.8%*	12	4.01	47	5.40
Innovation capacity	R&D expenditure (%)	33	0.95	1.01	*5.5%*	12	1.96	17	2.42

Source: Barnes and Morris, 2005

Governance in GVCs

A key feature of GVCs is that a large share of these chains is "governed" by a key lead actor. Some chains are driven by a lead buyer (as shown above, the pattern evident in the apparel GVC). In others key parameters are set by a holder of technological capabilities (often the case in the auto GVC). Drawing on the GVC theoretical framework, UNIDO publications on GVCs and technical cooperation activities in the field distinguished between four types of GVCs (Figure 7.10).

First, there are value chains where transactions occur as a consequence of market-based and arm's length relations. Little governance is exercised in these chains by

lead firms. Second, there are GVCs with hierarchical relationships involving the internalization of governance within the operations of a vertically integrated firm (generally a transnational corporation). In between are a series of relationships in which lead firms play an important role in long-lived and cooperative relationships with suppliers and customers, but with little or no equity participation. In some cases, there is a degree of power asymmetry and hierarchy in these relationships ("quasi-hierarchy" governance); in other cases the distribution of power between lead firms, suppliers and customers may be more balanced. In this case, the role of governance lies in the coordinating dispersed activities rather than imposing roles and standards along the value chain. An understanding of these power relations in governance is critical for the implementation of industrial policy as we will show in Chapter 11.

Figure 7.10: Categories of chain governance

Market	Network	Quasi-Hierarchy	Hierarchy
"Arm's length" relations between firms.	Coordination of activities due to mutual interdependence.	One firm is subordinated to another	Vertical integration within a firm – ownership of one firm (or parts of it) by another.
Indicators: • Lowest market dependence • No sales concentration • Knowledge asymmetry non-existent or nor an issue - Price set by the market • Commodities or standard products	**Indicators:** • Medium to high market dependence - Medium to high sales concentration - Low knowledge asymmetry • Price set by consensus • Complex products	**Indicators:** • High market dependence • High sales concentration - High knowledge asymmetry • One firm sets the prices for the other • High product/service specificity but weaker firm can be easily replaced	**Indicators:** • Highest market dependence • Highest sales concentration • Knowledge asymmetry varies • Highest price setting ability • Highest product specificity

Source: UNIDO, 2011b, p.55

CHAPTER 8

BRINGING FIRMS TOGETHER FOR COLLECTIVE EFFICIENCY: INDUSTRIAL PARKS, EXPORT-PROCESSING ZONES (EPZS) AND CLUSTERS

The previous chapter showed the worldwide spread of economic activities, resulting from the growing division of labour and fragmentation of production. It also looked into how value generation gears up by linking consecutive stages of production within GVCs to gain from the advantages of specialization. The locus of activities at each stage along the value chain is the firm. It is private and public firms, MNCs or local suppliers, large or small companies where the productive, technological, managerial and linkage capabilities are brought together to generate value, which is later exchanged within and across value chains. Large international firms play a dominant role as buyers of the output and "governors of the value chain". Large domestic firms are gradually learning the requirements of international markets and assuming an intermediary role between "governors" and other domestic suppliers. At the same time, small and medium enterprises, due to their innate resource constraints, are facing significant competitive challenges.

Many developing countries have based their export-led strategies on the creation of these dedicated industrial zones. A key idea of UNIDO guiding its technical cooperation delivery has been that firms can be more efficient and improve their business capabilities if they are brought closer together geographically. Geographical

proximity can increase the productivity of firms through observation, learning and by sharing common services; improve their capacity to innovate by allowing firms to focus on what they are good at; and encourage the establishment of new businesses as business opportunities become more transparent and are easier to seize. Bringing firms together can be done in different forms but three have predominated in UNIDO's thinking: industrial parks, export processing zones and clusters.

8.1. Industrial parks

An important local instrument to support industrial development is an industrial estate or industrial park. The concept of industrial parks emerged in industrialized countries to promote and manage industrial development and provide cost-effective infrastructure and communal services. In the early 1970s, the development and operation of industrial parks tended to be driven by the public sector. Over time, the private sector took on a greater role and this evolved into a coordinated public-private partnership model with a focus on science and technology. Subsequently, in the late 1990s, industrial parks started to focus on the commercialization of new knowledge and technology. Since 2000 a new generation of eco-industrial parks emerged.

By clustering in industrial parks, enterprises can take advantage of public infrastructures, tap into neighbouring expertise, cut down costs on construction and common facilities and gain access to nearby skilled labour markets, as well as research and educational facilities. Buyers, producers, and suppliers operate in the same location, thus cutting transaction costs of economic learning and establishing new standards and norms of entrepreneurial behaviour. Moreover, the concentration of certain types of companies attracts innovation and investors and may further facilitate the development of clusters. Another major advantage of industrial parks is that they provide an institutional framework, modern services and physical infrastructure that may not be available in the rest of the country. The influence of industrial parks on the overall development of a region is also important as they present a feasible option for increasing employment in regions. When industrial parks are matched with higher standards of environmental and social responsibility, the application of resource-efficient and cleaner production methods, and the reuse of waste energy and waste materials, they can evolve into eco-industrial parks. However, improper management, lack of knowledge or poor infrastructure may lead to high operational costs, poor environmental practices, and cause pollution and traffic congestion.

Since the 1975 Lima Conference, UNIDO has conducted several studies and organized seminars on various aspects of industrial estates and on the closely related questions of small-scale industries. Most of them were dedicated to sharing national experiences and showcasing projects, with the emphasis on the mechanics of estate design, planning, construction, management and operation. The Organization regarded industrial estates as the best and most economical tools for promoting the development of manufacturing industries, especially in the medium- and small-scale sectors in countries undergoing industrialization, and for promoting the economic development of rural and backward regions.

In November 1975, UNIDO and the Swedish International Development Authority (SIDA) initiated a joint programme to evaluate the effectiveness of industrial estates as an instrument of industrial development. When the establishment of the International Centre for Industrial Studies of UNIDO ensued, it adopted industrial parks as part of its work programme and brought this theme more closely in line with the Lima Plan of Action by defining as its main objective the development of "a concept and project design for the establishment of industrial estates based as much as possible on the use of local resources and related to local social, economic and cultural factors".

UNIDO has accumulated considerable experience in supporting initiatives for industrial park development. The Organization published its first guidelines for the establishment of industrial parks back in 1978. Between 1995 and 1996, UNIDO commissioned a series of studies on industrial estates that were gathered in its publication "Industrial Estates: Principles and Practice" published in 1997. Apart from helping with concrete projects in the field of industrial parks, UNIDO assisted countries in drafting laws regulating industrial parks and, later, free economic zones. It also performed feasibility studies on industrial zones in several countries. More recently UNIDO has engaged in mainstreaming the concept and capacitating countries to develop Eco-Industrial Parks. These are industrial parks where in addition to receiving common services, companies cooperate with each other to share information and resources efficiently (inputs, materials, water and energy) and reduce waste and pollution (UNIDO Regional Conference on Industrial Parks, 2012).

Industrial parks may serve as bases for the development of more advanced industrial infrastructure — export processing zones and science and technology parks. An EPZ, however, does not need to be constrained to a single location and derives its usefulness from its linkages to export markets rather than from shared infrastructures.

8.2. Export-processing zones (EPZs)

By any measure, the rise in popularity of export processing zones (EPZs) since the 1960s has been impressive. After World War II, the dominant protectionist doctrine of the 1930s was no longer favoured by policymakers around the world, who focused on economic expansion, primarily through growing exports between 1960 and 1973. Institutions such as the General Agreement on Tariffs and Trade (GATT) were established to promote international trade. Venables and Markusen (1997) note that there was considerable skepticism in the 1970s among many host governments and some economists concerning the positive role of FDI in the development of developing countries, which led to the creation of monopolies stifling domestic competition (Markusen and Venables, 1997, p.1).

The emergence of GVCs (Chapter 7), together with achievements in technology, communications and transport, allowed production to be carried out in different locations simultaneously. The original export processing zone idea was adapted to accommodate offshore processing. Ports of transport intersections were not always appropriate venues for new forms of manufacturing, so new sites were created in several countries or colonies, including prominent cases in Ireland, Hong Kong and Singapore. These states had the requisite policy environment, infrastructure and cost structure to allow foreign-export oriented direct investment in manufacturing, and were closely followed by similar sites in Taiwan, Republic of Korea, Malaysia, the Philippines, Mauritius and the Dominican Republic (UNIDO, 1996). Many UNIDO working papers highlighted the case of the Republic of Korea as an example of a successful EPZ strategy (UNIDO, 1996, p.149). The Economist estimates that as of 2015, there were over 4,300 such zones in the world, a far cry from the establishment of the first zone in Shannon, Ireland in 1959 (The Economist, 2015).

As Neveling (2015) recalls, UNIDO's involvement with such business infrastructure predates the foundation of the Organization itself:

"...In preparation for a decision on UNIDO's organizational structure and tasks, the United Nations Industrial Development Committee's associated Centre for Industrial Development (CID) sought models of industrialization. A questionnaire that was distributed to Member States via the UN Secretary- General in September 1966 pointed to the potential of export industries in accordance with ECOSOC resolution 1178 (XLI). By then several countries and colonial dependencies had EPZs up and running. Others, such as the Philippines, were developing EPZs with funding from USAID and other sources. Therefore, EPZs figured prominently in the CID progress report to the first session of UNIDO's general assembly,

the Industrial Development Board, in 1967. Accordingly, the board suggested that UNIDO promote EPZ-like regimes, and a group for export promotion was established as part of the Industrial Policies and Programming Division." (Neveling, 2015, p.76)

UNIDO approached EPZs not so much from a business perspective but it quickly began emphasizing its role in industrialization strategies, particularly export-oriented ones. One early observation by UNIDO in this context was that EPZs tended to account for a high proportion of manufacturing industry employment in countries systematically employing an export-oriented strategy, whereas the zones were relatively peripheral in countries following an import-substitution model and those with a large-scale export industry (UNIDO, 1980b, p.10).

The Organization began a long association with several such zones, recognizing their importance as an instrument of industrial development from their onset. UNIDO formed must notable partnerships with EPZs in Kaohsiung, Taiwan; Shannon, Ireland; and Mauritius. However, while UNIDO predominantly provided institutional support and technical cooperation services to these burgeoning EPZs, research into the growing phenomenon was not neglected. In 1970, the export promotion team under William Tanaka produced the first global survey of EPZ (UNIDO, 1980b). This was followed up by the publication of the first Handbook on Export Processing Zones in 1976, which remains one of UNIDO's most influential and best-selling publications.

As some scholars noted, UNIDO's enthusiastic drive to popularize EPZs somewhat flew in the face of its mandate to strengthen industrial policy (and by extension national sovereignty) in developing countries, and indeed conflicted with the underlying thrust of the Lima Declaration and attempts by developing countries to create a new international economic order. However, it must be said that while UNIDO was influential in promoting best practices and policy advice on the issue, it was not evangelical, pointing out the necessity of a nuanced approach in many of its publications, such as the 1996 Handbook referenced below:

"The Export Processing Zone (EPZ) concept has been used by many countries over the last 35 years to initiate and promote export-led industrial development. Some countries, especially in East and South East Asia, have used the EPZ with great success to initiate this type of development. Elsewhere, the concept has not always produced the expected benefits, often because of unsuitable location and poor infrastructure combined with ineffective management and an inappropriate policy environment... As a general rule, EPZs can be used in a country where suitable conditions for export-oriented industry cannot be created on a nationwide basis because of infrastructural deficiencies and administrative obstacles. But...it should be viewed as a temporary solution and a step towards a countrywide duty-free regime for exporters. It should not therefore be planned in isola-

tion, but as part of a broad, long-term strategy to develop an internationally competitive manufacturing sector." (UNIDO, 1996, p.13).

The economic benefits of EPZs were underlined in the Organization's research, with one study noting that value addition in EPZs was 25-30 per cent higher in the garment sector and 10-15 per cent higher in electronics compared to non-EPZ (UNIDO, 1996, p.6). UNIDO also drew attention to the relative paucity of cost-benefit studies for EPZs, also noting that while actors such as the World Bank had flagged the economic benefits of such infrastructure, most notably through employment creation in small economies, such studies had often neglected backwards linkages and technology transfer (UNIDO, 1996, p.10). This was attributed to the following causes:

- The inability of domestic suppliers to meet the quality, delivery and/or price standards of EPZ producers due a lack of skills, high duties and taxes on the inputs imported by domestic producers, and due to their limited access to foreign exchange and low-interest loans.
- A reluctance on the part of some expatriate managers to purchase locally.
- Inadequate stimuli for linkages and technology transfers (UNIDO, 1996).

Many commentators list the manifold advantages of an EPZ policy for governments in developing countries. For example, they can be a useful tool in the implementation of the overall economic growth strategy to enhance industry competitiveness and attract FDI. Through EPZs, governments may develop and diversify exports while maintaining protective barriers, to create jobs, and to pilot new policies and approaches (for example, in customs, legal, labour, and public private partnership aspects). EPZs also allow for more efficient government supervision of enterprises, provision of off-site infrastructure, and environmental controls (FIAS, 2008).[5]

[5] The criteria followed by ISTAT (1995) in the identification of Italian industrial districts were built on the basis of the conditions set in 1993 by the Ministry of Industry:

1. The ratio between the number of employees in manufacturing activities and in all the non-agricultural economic activities in the area should be higher than the equivalent national value;
2. The ratio between the number of employees in manufacturing activities with less than 250 employees and the total number of employees in manufacturing activities in the area should be higher than the equivalent national value;
3. The ratio between the number of employees in at least one industry and in all the manufacturing activities should be higher than the equivalent national value;
4. In at least one industry in which the local system has a share of employment higher than the national value, the share of employment in firms with less than 250 employees should be higher than the national value.

The criteria adopted by ISTAT are less restrictive that the ones set by the legislator.

Critiques of such zones are often concerned with potential downgrading of labour rights and working conditions, or a failure to extend the economic benefits beyond EPZs (Neveling, 2015). As one scholar wrote:

"…[T]he benefits of EPZs are limited. They are definitely not engines of development. For countries in the early stages of development, zones can be efficient and productive means of absorbing surplus labour. Even then, they will never be more than a modest part of the solution to the vast unemployment problems of these countries." (Warr, 1989, p.85)

However, for UNIDO the benefits of EPZs have generally outweighed the associated costs, with wages tending to be significantly higher than in the wider economies of the countries concerned, and a greater proportion of female employees working in EPZs, albeit generally in lower-paid positions (UNIDO, 1996). Research also concluded that patterns of women's employment were also to be observed in export-oriented industries outside the EPZs (UNIDO 1980, p.12). Similarly, national legislation on labour protection tends to apply to EPZs, though in some countries labour unions were found to be hostile to large-scale female employment in EPZs (UNIDO, 1980, p. 33). EPZs are, however, viewed as an intermediate development solution towards a countrywide duty-free strategy, and should not be developed in isolation (UNIDO, 1980b, p. 66).

Similarly, many policy recommendations for successful EPZs tend to focus on regulatory instruments and the role of the private sector therein. FIAS, for example, elaborated a checklist for EPZs encompassing compliance with broad legal concepts of territoriality; private zone development; zone designation criteria; WTO ownership criteria and ILO labour standards (FIAS, 1998). In contrast, UNIDO underlined not only regulatory instruments and incentives but also export promotion tools. It also stressed the importance of infrastructural appropriateness for EPZ selection, including proximity to transport and communication facilities, good planning and management (probably by a private sector entity) and support from efficient regulatory agencies.

A significant volume of work was also undertaken concerning the prospect of backwards and forwards linkages. It was observed that the more extensive the linkages, the wider the benefits for the overall economy in the shorter term. However, if linkages were limited, then it was unlikely that zones could generate long-term benefits. It was also found that there exists a multiplier effect for the salaries of the employees of EPZs, primarily through the consumption of domestic consumer goods. However, as previously demonstrated, there was a more limited scope for backward linkages

due to the limited capacity of local companies to meet the needs of the multitude of multinational companies involved in EPZs (Markusen and Venables, 1997, p.25).

Drawing on empirical data from the Irish and Korean EPZs, UNIDO advocated that backward linkages from EPZs could increase over time:

"The available evidence indicates that backward linkages, although initially very limited, can, at least in some cases, increase. In the Masan zone in the Republic of Korea, imports constituted 72 per cent of exports in 1971. By 1978 this ration had fallen to 52 per cent. In the same zone the share of domestic raw materials in total foreign currency earnings increased from 6 per cent in 1971 to 37 per cent in 1975. Similar figures for Shannon in the Republic of Ireland, (the oldest EPZ in operation) reveal a similar pattern. Shannon's imports averaged 81 per cent of the export value between 1953 [and] 1963; for the period 1964-1975 they had fallen to 63 per cent. Imports included both raw materials and capital equipment. Irish raw materials account for about 8 per cent of total materials used. Firms processing large quantities of Irish raw materials are located outside the zone, close to the source of raw materials." (UNIDO, 1980b, p.26)

The Organization's research pointed towards a positive effect of an EPZ strategy on developing countries with respect to their balance of payments, although the prospects for technology transfer from EPZs were deemed to be limited in scope owing to several factors:

- MNCs' favoured method of locating only specific aspects of production which were subject to intense cost competitive pressures in globalized markets.
- The predominance of assembly-line type of operations and the lack of complex production processes and local research and development.
- The concentration of research and development within the head offices of the transnational corporations, strengthening the external control over the applied technology.
- The outward-oriented enclave character of an EPZ, which can prevent technology transfer through the establishment of a commercial relationship between the companies in the zone, with local firms unable to access the same (UNIDO, 1980b, pp.31-32).

The Organization has persistently advocated that EPZs do not represent a "silver bullet" solution to the challenges of export-led industrial development, but that they offer an intermediate solution whereby the privileges of the EPZ are extended to the wider economy over time and as part of a multifaceted industrialization strategy (UNIDO, 1980b).

The harnessing of EPZs for sustainable development remains at the heart of UNIDO's mandate to promote inclusive and sustainable industrial development (ISID), as evidenced by its flagship Programme for Country Partnerships (PCP). The PCPs represent a holistic and comprehensive strategy to achieve ISID, with the initial PCPs established in Senegal, Ethiopia and Peru in line with the respective national industrialization strategies of those countries. Chapter 11 discusses future trends and initiatives in this area.

8.3. Clusters and SMEs growth in developing economies

The period between 1950 and 1975 was an era of historically high rates of economic and productivity growth in the industrialized world. A number of attempts were made to explain why productivity and growth rates moved on to a lower plateau in the following decades. One of the explanations was that the transition to a lower growth path was marked by the exhaustion of the mass-production paradigm in these advanced economies. In brief, mass production involved the use of inflexible special-purpose equipment, operating at increasingly large scale, to produce standardized products. But as consumer incomes rose in these high-income economies, so did the pressure on producers to manufacture more customized goods, made in smaller volumes and with higher rates of product differentiation and innovation.

Comparative studies (Piore and Sabel, 1984; Best, 1990) highlighted the surprising role played by clusters of SMEs in some advanced economies (particularly Italy) in meeting the needs of these demanding markets. These studies challenged the widely-held view that small firms operated at the bottom of the industrial food chain. In many cases, industrial clusters were highly innovative, export-oriented and sustained high and growing incomes. As a UNIDO Discussion Paper documented (Table 8.1), in most sectors the growth rate of firms in Italian industrial clusters outperformed that of firms operating outside of clusters. This comparative study also showed that between 1994 and 1998 in Italy, salaries inside the industrial clusters rose more rapidly than those outside clusters for both blue- and white-collar workers in the machinery and metal products sector, for blue-collar workers in the rubber and plastics as well as woodworking sectors, and for white-collar workers in the leather-shoe-textiles-garments and the rubber-plastics sectors (Table 8.2).

Table 8.1: Comparative growth performance of Italian firms operating within and outside industrial clusters, 1991-1996[6]

	Outside ID		
Manufacturing Sector	***1996***	***1991***	***Growth***
Food industry	295,631	318,778	*-7.3%*
Textiles, clothing	257,170	311,919	*-17.6%*
Leather and tanning industries	77,928	82,540	*-5.6%*
Woodworking and wood products	99,538	110,857	*-10.2%*
Paper, printing, publishing	176,038	196,588	*-10.5%*
Coke, oil, fuels	22,112	27,053	*-18.3%*
Chemicals and man-made fibres	153,037	182,123	*-16.0%*
Rubber and plastics	104,717	99,097	*5.7%*
Processing of non-metallic minerals	136,975	160,100	*-14.4%*
Metalworking and metal products	402,805	444,363	*-9.4%*
Mechanical appliances and machinery	284,782	282,473	*0.8%*
Electrical and optical appliances and machinery	307,434	350,500	*-12.3%*
Means of transport	230,956	289,154	*-20.1%*
Other manufacturing industries	134,163	133,709	*0.3%*
TOTAL	2,683,286	2,989,254	*-10.2%*

[6] The criteria followed by ISTAT (1995) in the identification of Italian industrial districts were built on the basis of the conditions set in 1993 by the Ministry of Industry:

1. The ratio between the number of employees in manufacturing activities and in all the non-agricultural economic activities in the area should be higher than the equivalent national value;
2. The ratio between the number of employees in manufacturing activities with less than 250 employees and the total number of employees in manufacturing activities in the area should be higher than the equivalent national value;
3. The ratio between the number of employees in at least one industry and in all the manufacturing activities should be higher than the equivalent national value;
4. In at least one industry in which the local system has a share of employment higher than the national value, the share of employment in firms with less than 250 employees should be higher than the national value.

The criteria adopted by ISTAT are less restrictive that the ones set by the legislator.

Inside ID		
1996	*1991*	*Growth*
150,883	155,278	*-2.8%*
434,555	510,858	*-14.9%*
152,615	161,002	*-5.2%*
70,756	75,241	*-6.0%*
84,398	87,255	*-3.3%*
2,035	2,004	*1.5%*
56,205	55,255	*1.7%*
93,684	80,340	*16.6%*
113,849	116,243	*-2.1%*
354,960	340,604	*4.2%*
269,323	256,467	*5.0%*
149,581	138,809	*7.8%*
55,572	60,991	*-8.9%*
184,075	180,886	*1.8%*
2,172,491	2,221,233	*-2.2%*

Table 8.2: Growth in salaries inside and outside industrial districts, by sectors and labour type in Italy, 1994-1998, in 1000 euros and by index numbers[7]

In€,000	Machinery - Metal Products			Leather - Shoes - Textiles – Garment		
Blue Collars	1994	1996	1998	1994	1996	1998
Inside ID	15.736	16.972	18.287	12.765	13.781	14.640
Outside ID	14.981	16.025	16.944	12.578	13.387	14.160
Total	15.140	16.225	17.227	12.641	13.520	14.322
White Collars	1994	1996	1998	1994	1996	1998
Inside ID	20.936	23.073	24.915	17.522	19.023	20.570
Outside ID	18.864	20.205	21.452	16.112	16.792	17.394
Total	19.300	20.809	22.181	16.763	18.115	19.489
Indexed, 1994=100	Machinery - Metal Products			Leather - Shoes - Textiles - Garment		
Blue Collars	1994	1996	1998	1994	1996	1998
Inside ID	100.0	107.9	116.2	100.0	108.0	114.6
Outside ID	100.0	107.0	113.1	100.0	106.8	113.2
Total	100.0	107.1	113.8	100.0	107.2	113.7
White Collars	1994	1996	1998	1994	1996	1998
Inside ID	100.0	110.2	119.0	100.0	108.8	118.1
Outside ID	100.0	107.1	113.8	100.0	105.0	109.9
Total	100.0	107.8	114.9	100.0	107.5	116.5

Source: In Nadvi & Barrientos, 2004. Based on information from INPS – Istituto Nazionale di Previdenza Sociale, Osservatorio sulle imprese: http://www.inps.it/doc/sas_stat/imprese/imprese.html and ISTAT - Istituto Nazionale di Statistica, Censimento Intermedio dell'Industria e dei Servizi: http://cens.istat.it/

[7] The differences in growth of salaries and dispersion inside and outside Industrial Districts were calculated considering the classification of Italian Industrial Districts proposed by IPI on the basis of the criteria set by ISTAT. The list of Italian provinces (NUTS 3 in the Eurostat administrative classification of territorial units in Europe) where Industrial Districts are located (according to the ISTAT classification) was matched with provincial data on wages and dispersion provided by INPS. This allowed the identification of two groups of Italian provinces: one hosting industrial districts involved in the production of the manufacturing products reported above, and one without industrial districts in the same industrial sectors. It was preferred to report macro-aggregates of some manufacturing activities (machinery-metal products and leather-shoes-textiles-garment products) in order to avoid possible mismatching problems deriving from a different classification of industrial activities adopted in the two different data banks.

Rubber & Plastics			*Woodworking*		
1994	*1996*	*1998*	*1994*	*1996*	*1998*
15.123	16.170	17.444	13.389	14.450	15.411
14.795	15.702	16.833	13.204	14.164	14.909
14.812	15.727	16.865	13.235	14.212	14.993
1994	*1996*	*1998*	*1994*	*1996*	*1998*
20.722	22.716	24.328	16.903	18.154	19.586
19.244	20.550	22.080	15.693	16.901	18.077
19.322	20.664	22.198	15.897	17.112	18.331
Rubber & Plastics			*Woodworking*		
1994	*1996*	*1998*	*1994*	*1996*	*1998*
100.0	*106.9*	*115.4*	*100.0*	*107.9*	*115.1*
100.0	*106.2*	*113.9*	*100.0*	*107.3*	*113.0*
100.0	*106.2*	*114.0*	*100.0*	*107.4*	*113.3*
1994	*1996*	*1998*	*1994*	*1996*	*1998*
100.0	*109.6*	*117.4*	*100.0*	*107.4*	*115.8*
100.0	*107.0*	*115.3*	*100.0*	*107.7*	*115.3*
100.0	*107.2*	*115.4*	*100.0*	*107.7*	*115.4*

In Chapter 2, we observed that these clusters were successful mainly because they benefited from "externalities". That is, their geographical agglomeration meant that there was a critical mass of local suppliers, customers and skills. In the case of the more successful districts, the cluster of firms also engaged in various forms of collective action designed to enhance not just the offering of individual firms, but of the district as a whole. The key to achieving these gains lay in the horizontal linkages developed between SMEs, and this in turn highlighted the importance of trust and networking.

As in the case of global value chains (Chapter 7), UNIDO's core technical support activities made the Organization a relatively early player amongst global institutions in recognizing the significance of industrial clusters in developing economies. Working with leading experts in the field, UNIDO made important contributions to this evolving research agenda in two important respects — documenting the character and significance of clusters of SMEs in developing economies, and exploring the distinctive manner in which clusters contribute to poverty alleviation and capability building in developing economies.

8.4. The character and significance of SME clusters in developing economies

The recognition of the role played by clusters in industrial development of developed economies was based on the experience of relatively sophisticated small- and medium-sized firms, often selling into high-income markets. Clusters, however, play a more variegated role in developing economies, spanning the spectrum between agglomerations of sophisticated exporting firms and clusters of marginal and survivalist firms feeding into very local and low-income final markets.

UNIDO research has not only highlighted the importance of clusters in a variety of developing economy settings, but sought to explain the factors determining their success and failure. This research was undertaken in background papers prepared for the Industrial Development Reports in 2009 (on Challenges for the Bottom Billion and Middle-Income Countries) and 2016 (on The Role of Technology and Innovation in Inclusive and Sustainable Development).

Successful exporting clusters in Latin America and Asia

The first body of research was undertaken on a group of seven successful exporting clusters, three of which were in Latin America (Argentina, Brazil and Chile) and four in Asia (India, Indonesia, Lao and Malaysia) (Table 8.3).

In four of the clusters (automotive in Argentina, pulp and paper in Brazil, salmon in Chile and electronics in Malaysia), export growth rates were higher than in the same sector of the entire economy; in the other three cases (leather in Chennai, automotive in Indonesia and agro and wood in Lao), the rate of export growth was similar to or marginally higher than the national average. Each of these clusters benefited from specific advantages which fed into their export success. Some of these advantages reflected their access to natural resources. In other cases their export success was based on integration into TNC-led global value chains, to the development of local capabilities and to the effectiveness of government support measures.

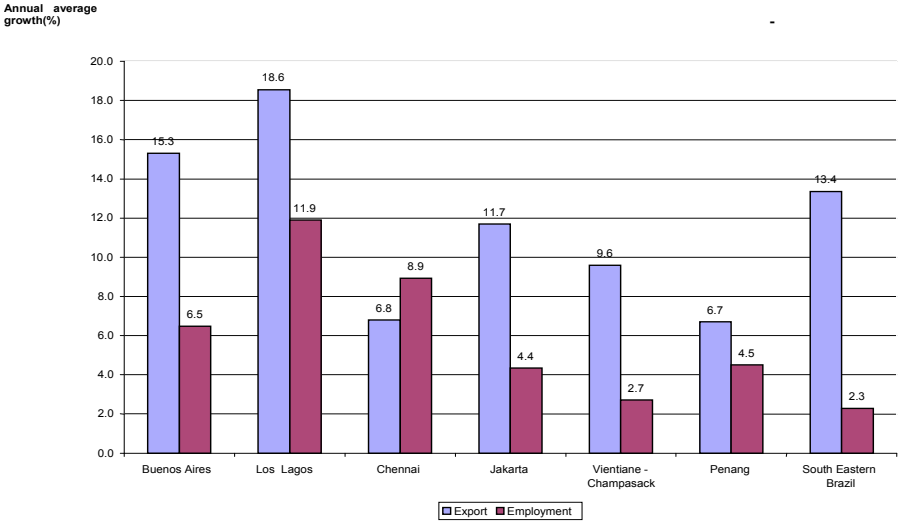
Table 8.3: Selected dynamic industrial locations, 2000-2006

Country	Industrial Location	Product	Average annual growth rate of exports (Percentage)		Number of Surveyed Firms	Principal drivers of exports
			National	Location		
Argentina	Buenos Aires	Automotive	11.7	15.3	50	Global integration of domestic subsidiaries of automotive assemblers and component manufacturers into the value chains of transnational corporations
Brazil	South Eastern Brazil	Pulp and paper	11.6	13.4	13	Operational advantage of proximity to high quality raw materials
Chile	Los Lagos	Salmon	11.1	18.6	50	Adoption and adaptation of best practices in salmon culture and processing
India	Chennai	Leather	6.3	6.8	100	Institutional and policy direction and support for technological upgrading and environmental compliance
Indonesia	Jakarta	Automotive	11.7	11.7	94	Domestic capability building from specialization in the production of selected auto parts (modules) in the transnational production networks and appropriate incentives.
Lao PDR	Vientiane-Champasack	Agro and Wood	5.5	5.6	100	Proximity to raw materials and preferential market access.
Malaysia	Penang	Electric-electronics	4.6	6.7	100	Transnational corporations taking advantage of attractive financial incentives and excellent basic infrastructure

Source: UNIDO, 2008

In all cases, the rate of export growth exceeded that of employment growth. Nevertheless, employment growth was greater than 2.5 per cent p. a. and in the most successful cluster (salmon in Chile), annual employment rose by 12 per cent in the six years between 2000 and 2006 (Figure 8.1). This success in export markets was reflected differentially in real earnings amongst the clusters. In Chile (salmon), India (leather) and South-Eastern Brazil (paper and pulp), average wages grew by 27.1, 10.1 and 9.7 per cent, respectively, over the period 2000-2006. By contrast, real wages grew much slower in Argentina (automotive), Laos (agro and wood) and Malaysia (electronics).

Figure 8.1: Export and employment growth in the seven exporting clusters



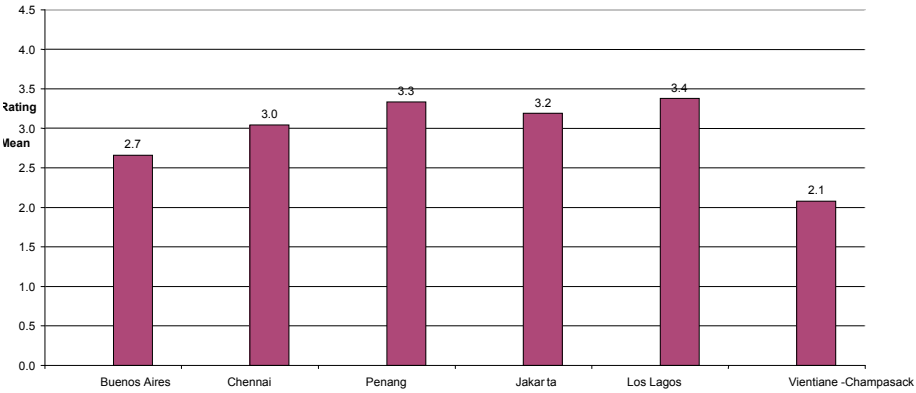
Source: UNIDO, 2008

Statistical analysis shows a positive relationship between skills intensity and export intensity in Malaysia (electronics), Argentina (automotive) and India (leather). The relationship was particularly strong in Malaysia where there is a premium for skilled labour. Malaysia has faced growing deficits in the supply of human capital since 1995. However, the relationship between export-intensity and skill-intensity was not statistically significant in Indonesia (automotive), Laos (agro and wood) and Chile (salmon)

By the nature of their final markets, export-oriented locations are driven to improve environmental standards. Firms have responded in different ways to control environmental pollution and to meet external pressures and improve efficiency levels. Using self-assessed

ratings from 0-5, the environmental practices score in the clusters ranged from 2.1 in Vietnam (agro and wood) to 3.4 in Chile (salmon). The mean for environmental practices reached or exceeded 3.0:3.3in Malaysia (electronics), 3.2 in Indonesia (automotive) and 3.0 inIndia (leather) (Figure 9.2).

Figure 8.2: Firm-level environmental practices, selected locations, 2006



Source: UNIDO, 2008

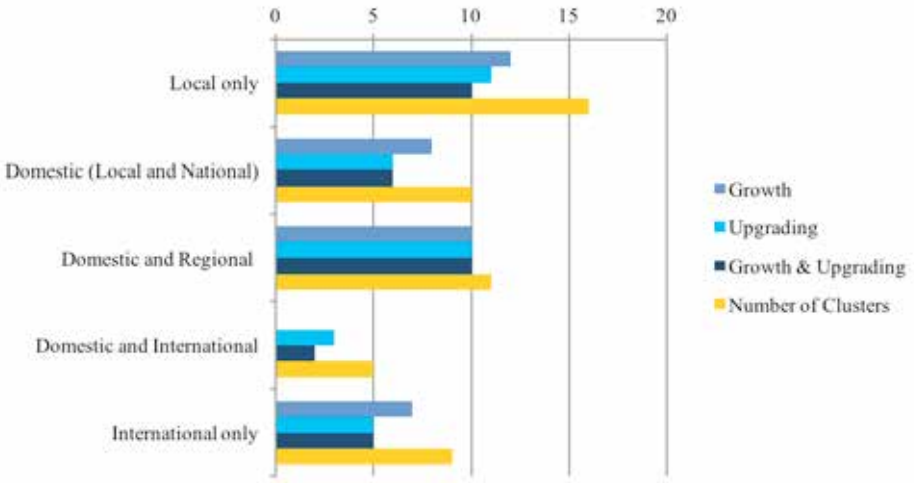
The experience of 25 African clusters

As we already noted, the industrial sector in Africa has shown little sign of dynamism in recent decades, with a low and falling share of recorded global MVA in manufacturing. These aggregate data largely refer to the role played by the formal manufacturing sector. Yet in many parts of the developing world, manufacturing occurs in the informal sector, much of which is not captured in industrial statistics. This under-recording is especially prevalent in Africa, including in African industrial clusters.

A background report prepared for the 2016 IDR analysed the experience of 25 African clusters, seeking, among other objectives, to explore the extent to which upgrading efforts were linked to different final markets; the extent to which these clusters benefited from externalities and how this was affected by the markets they serve; whether they engaged in upgrading efforts; and which form of institutional support proves most effective. Many of these clusters are either wholly or largely unrecorded in national industrial statistics.

Beginning with the link between upgrading and final markets (Figure 8.3), each of the three clusters selling primarily into global markets, the six clusters selling into national markets and the ten clusters selling into domestic and regional markets show signs of sustained growth and upgrading. By contrast, the seven clusters selling into the immediate vicinity show the least signs of growth and upgrading — they are predominantly survivalist clusters. It is not possible to determine the direction of causality in these numbers; whether only dynamic clusters can sell outside local markets, or whether the act of selling outside local markets leads to enhanced growth and upgrading.

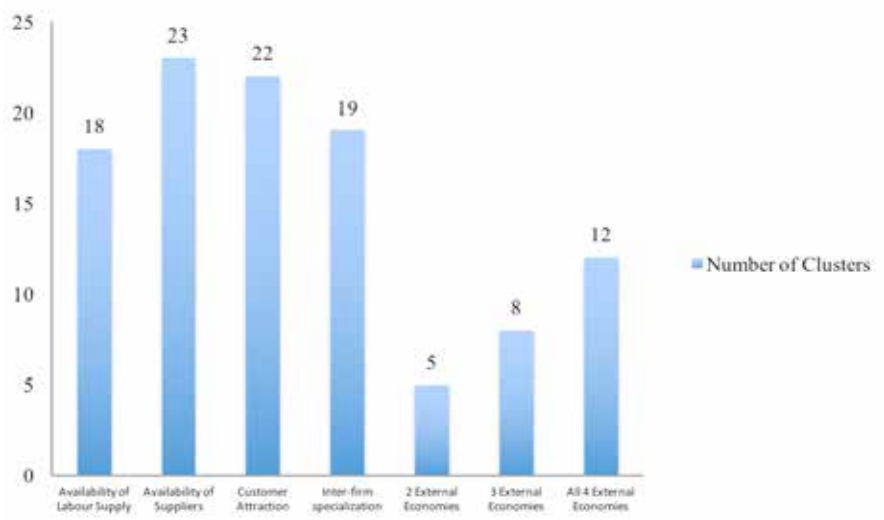
Figure 8.3: 25 African industrial clusters — final market and cluster dynamism (number of clusters)



Source: Kaplinsky, 2015

All of the 25 clusters benefit from at least one of four categories of external economies — labour skills spillovers, proximity of suppliers, proximity of customers and the development of inter-firm specialization and the division of labour. Figure 8.4 shows the prevalence of individual external economies in these 25 clusters. It explains how 12 clusters benefit from all four types of spillover, eight from three types, and five from two types of externalities. In none of the clusters firms benefited from only one type of external economy.

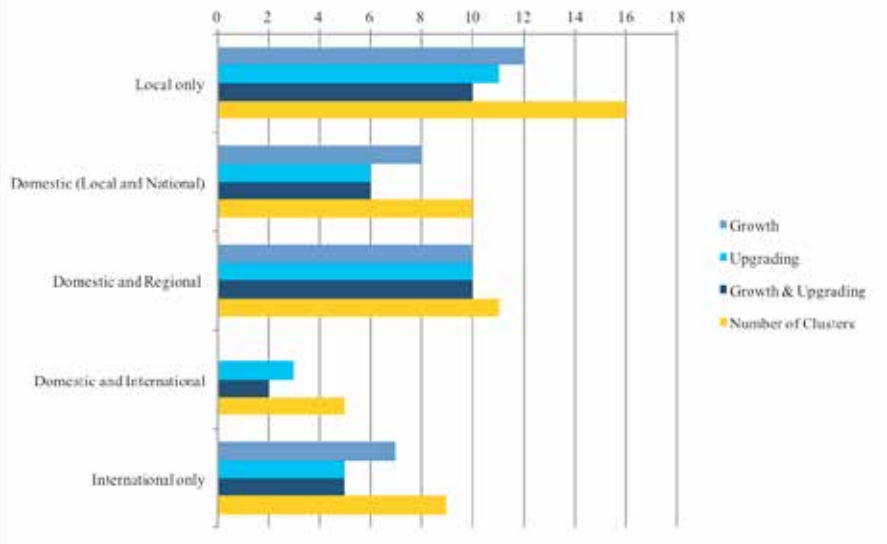
Figure 8.4: 25 African industrial clusters — prevalence of external economies (number of clusters)



Source: Kaplinsky, 2015

International experience shows that clusters achieve collective efficiency when members build on these accidental external economies and take deliberate joint action to strengthen cluster performance. Figure 8.5 addresses three types of joint action – skill development, marketing and logistics – and the extent to which this is associated with cluster dynamism. Approximately 75 per cent of the 16 clusters cooperating in skill development have experienced sustained growth or upgrading, or both. A smaller number of clusters cooperated in either marketing (10 of 25 clusters) or logistics (11 of 25 clusters). Logistics cooperation was particularly closely associated with growth and upgrading, whereas joint marketing did not appear to be as important. The more clusters engaged in different types of joint action simultaneously, the more likely this was associated with cluster dynamism. Again, causality cannot be imputed from these aggregate data alone.

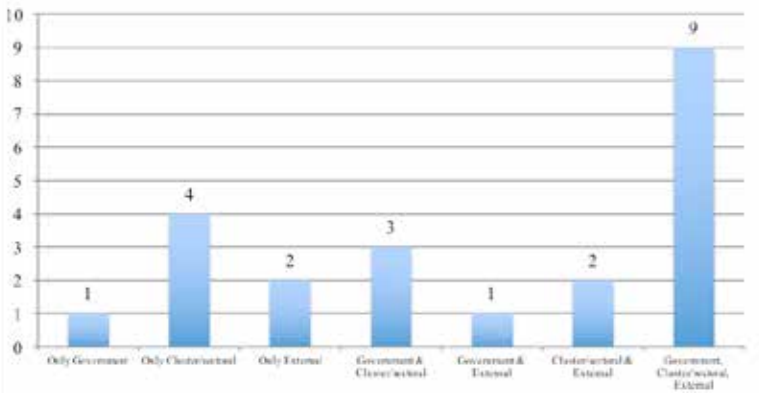
Figure 8.5: 25 African industrial clusters — cluster dynamism and join action (number of clusters)



Source: Kaplinsky, 2015

Finally, there is a variety of forms of joint institutional activities. One source of support is through the government, either national or local, or through both. Another form of institution is that created by the members of the cluster or by sectoral associations. These institutions are both private-sector driven. The third form of support is provided by parties external to the economy, such as through aid or NGOs. Figure 8.6 shows the distribution of these institutional support programmes in the 25 clusters. The largest number of clusters received multiple types of support — from government, through the firm's own contributions and from external sources. Four of the cluster support institutions were entirely the result of private-sector cluster and sectoral initiatives, and an additional three involved collaborations between governments and the private sector.

Figure 8.6: 25 African Industrial Clusters — Institutional support for joint action (number of clusters)



Source: Kaplinsky, 2015

8.5. Clusters, poverty alleviation and capability building in developing economies

To what extent do clusters in developing economies affect the growth of capabilities and income of the poor? When focusing on industrial clusters in low-income countries and clusters involving poor producers, it is important to move beyond the role played by clusters in GDP and export growth. The building of capabilities and the widening of participation are not only often as important as income in redressing inequalities, but are generally also key determinants of sustainable income growth.

Drawing on the analysis of the practical work by technical support staff in developing economies, UNIDO's analysis of cluster impacts on distribution identifies three sets of interventions which determine the performance of clusters. These are support provided to individual firms ("enterprise development"), support for groups of firms ("business linkages") and assistance provided by local governance institutions. This describes a role for both the private sector ("Business Development Services") and local government in cluster development.

In each of these three categories of action a range of different practices can be observed which affect cluster development (Figure 8.7). For example, enterprise development has been aided by programmes fostering enterprise creation, upgrading and the diffusion of standards. Linkages have been promoted through the provision

of market information, incorporation in value chains, participation in trade fairs, bulk input purchases and access to finance. Local governance can enhance the voice of SMEs and clusters, provide financial and practical support for market penetration and help to develop cluster dynamics. At the same time, each of these categories of support have potential impacts on distribution, as can be seen from Figure 8.7.

Figure 8.7: The effect of cluster development interventions on the reduction of poverty

Cluster development programme		
Areas of Intervention	**Expected effects (examples)**	**Relevance for Poverty alleviation**
Enterprise development	*Implemented through/with local BDS providers* Private sector in the cluster enhanced leading to creation of new enterprises (both formal and informal), employment generation, up-skilling of workers, improved working conditions, technology upgradation, reduced environmental impact of production, introduction of quality control mechanisms (including ISO certification), improved product/process quality, broadened product range.	• Income generation • Employment generation • Inclusion in "productive" social groups • Skill upgradation of workers • Improvement of working conditions • Reduction of drudgery Formalization of skill supply sources
Business linkages	Promotion of existing/newly created enterprises through access to market information, entry in new markets (national/ international), insertion in national/ regional/ global value chains, greater availability of credit, development of internal market conditions, development of local BDS market, export generation, participation in fairs (national, international), cost reduction through bulk purchase, vendor upgradation.	• Increased security through market diversification • Creation of disposable income/demand in the cluster • Pressure for enterprise development
Local governance	Promotion of the idea of cooperation among enterprises, dissemination of win-win mentality, creation of vertical/horizontal networks, promotion of export consortia, creation of umbrella organizations, consensus on cluster wide agenda/priorities, institutional networking, increased political relevance at the local/national level, increased use of untapped support resources	• Increased social capital locally • Articulation of local democratic process • Increased responsiveness of local support institutions • Improved environmental conditions

Source: Nadvi and Barrientos, 2004

But beyond potential, what in reality are the observed distributional outcomes from cluster expansion? As Figure 8.8 shows, the outcomes are diverse. There are some cases where there is an observable linkage between cluster growth and poverty

alleviation, including in the case of informal sector enterprises in developing economies. But these positive win-win outcomes are not inevitable, as the contrasting experiences in Figure 8.8 illustrate. The function of research is to determine why these experiences differ, and how various policy interventions can make a difference.

Figure 8.8: Positive and negative impacts of clusters on poverty reduction

Positive effects of clusters on reducing poverty	Examples
Generates employment for the very poor in rural and urban areas	Clusters engaged in labour-intensive sectors generally have a positive effective on generating employment. The Shoe cluster of Agra, India, employed 60,000 workers in some "5,000, mostly informal small scale units". The Lake Victoria cluster in Uganda, generates work for fishing communities who use limited tools and have few amenities.
Enhances the capacity of small firms to access markets, and acquire skills, knowledge, credit and information	The enhanced capacities of small firms reduces companies' vulnerability to the exigencies of globalization, thereby enhancing the well-being of workers and producers. In Kumasi, Ghana, the auto-parts cluster resulted in improved market access, labor market pooling and extensive subcontracting. Clustered producers benefited from local technological spillovers and knowledge flows.
Adverse outcomes in cluster development for poverty reduction	
Marginalization of some categories of workers by not being provided the requisite training and skills	As firms acquired new functions, the new, more skilled and better paid jobs were allocated predominantly, if not uniformly, to men. In some cases there was a reluctance of companies to invest in enhancing the skills of female employees. Women were seen as transient within the labour force, prone to leaving work as they married and raised families. In the Tiruppur in India women constituted 65 per cent of the cluster's labour force, but were largely employed in lower paid tasks of sewing and packing.
Ties with external buyers increase important, but these external linkages are unevenly distributed within the cluster. Smaller producers have less autonomy in their ties with larger producers within the cluster.	In the Agra footwear cluster in India, despite cluster growth,employment shrank and particular segments of the cluster's labour force were squeezed. This was felt unevenly through the cluster; while employment in the export and premium domestic market segments of the cluster rose, it fell in the those parts of the industry who were not linked to these lead buyers.

Source: Nadvi and Barrientos, 2004

CHAPTER 9

ENERGY AND THE ENVIRONMENT

As was shown in Chapter 2, the global diffusion of industry to the developing world from the late 1980s was coterminous with the emergence of serious and negative environmental impacts, both within individual economies and in the global ecosystem.

A large number of global institutions are now addressing what is widely accepted to be the single biggest challenge confronting humankind: climate change. UNIDO, too, is playing a role in the evolving discussion around the environment and in the development of appropriate analyses and policy responses, particularly those designed to mitigate environmentally-damaging production systems. As we saw in Chapter 2, since 1990 the Organization has made several distinctive intellectual contributions to this evolving agenda — mapping the industrial specificity of greenhouse gas emissions; suggesting the introduction of energy management system standards; helping to develop the concepts of green industry and clean production; providing evidence to show that there are numerous opportunities for win-win outcomes through which a reduced environmental impact can be achieved with increased profitability and cost-reduction; and providing detailed case-study evidence to back the diffusion of environmentally-friendly industrial technologies in developing economies.

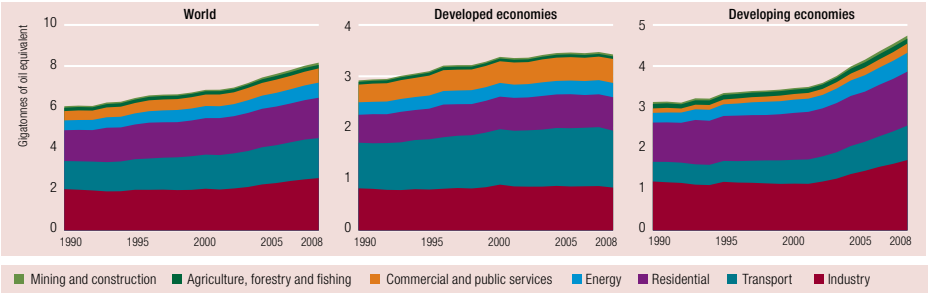
9.1. The sectoral specificity of greenhouse gas emissions

The sectoral incidence of energy intensive industrial production

Reports from the International Energy Agency, the International Panel on Climate Change and a range of other institutions evidence the growth in the global consumption of energy. Notwithstanding the growing share of renewable energy generation in both developed economies (Germany, Portugal and the UK) and developing economies (China, India, Nigeria and South Africa), the global economy continues to spew out environmentally harmful greenhouse gases at an increasing rate. The IEA analysis (Figure 9.1) shows that between 1990 and 2008, the total global energy consumption per capita increased by more than one-third. This growth was disproportionately large

in the developing world, and within that, within the industrial sector in developing countries, reflecting their growing share of global MVA during this period.

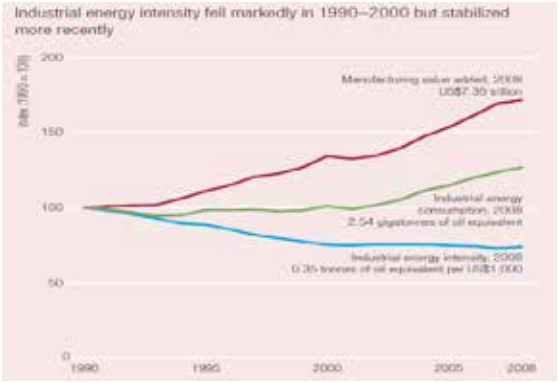
Figure 9.1: Growth in global energy consumption per capita by broad economic sector



Source: UNIDO, 2011d, p.25

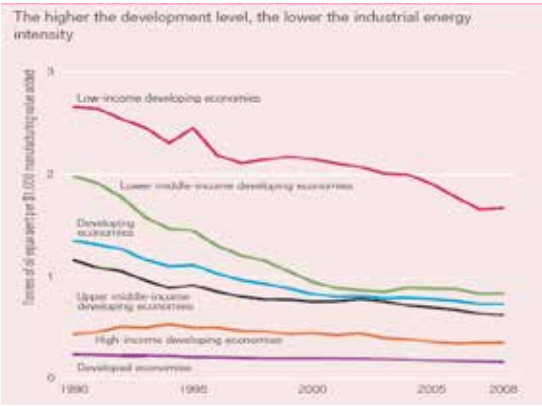
UNIDO's analysis of the use of energy within the industrial sector augments this aggregated picture and highlights a number of specific and important trends associated with the industrial sector. First, during the first ten years of this 18-year period there was a marked fall in the energy intensity of global industrial production. But after this, the rate of improvement slowed considerably (Figure 9.2). Second, energy utilization in industrial activities was much higher in countries with low per capita incomes (Figure 9.3). This reflected a combination of factors, including the higher propensity to adopt energy-efficient production methods in many higher-income countries, but also the global relocation of many energy-intensive (and environmentally unfriendly) industrial processes and activities from higher-income to lower-income economies.

Figure 9.2: Global trends in manufacturing value added, industrial energy consumption and industrial energy intensity, 1990–2008



Note: Industrial energy intensity in 2000 USD.

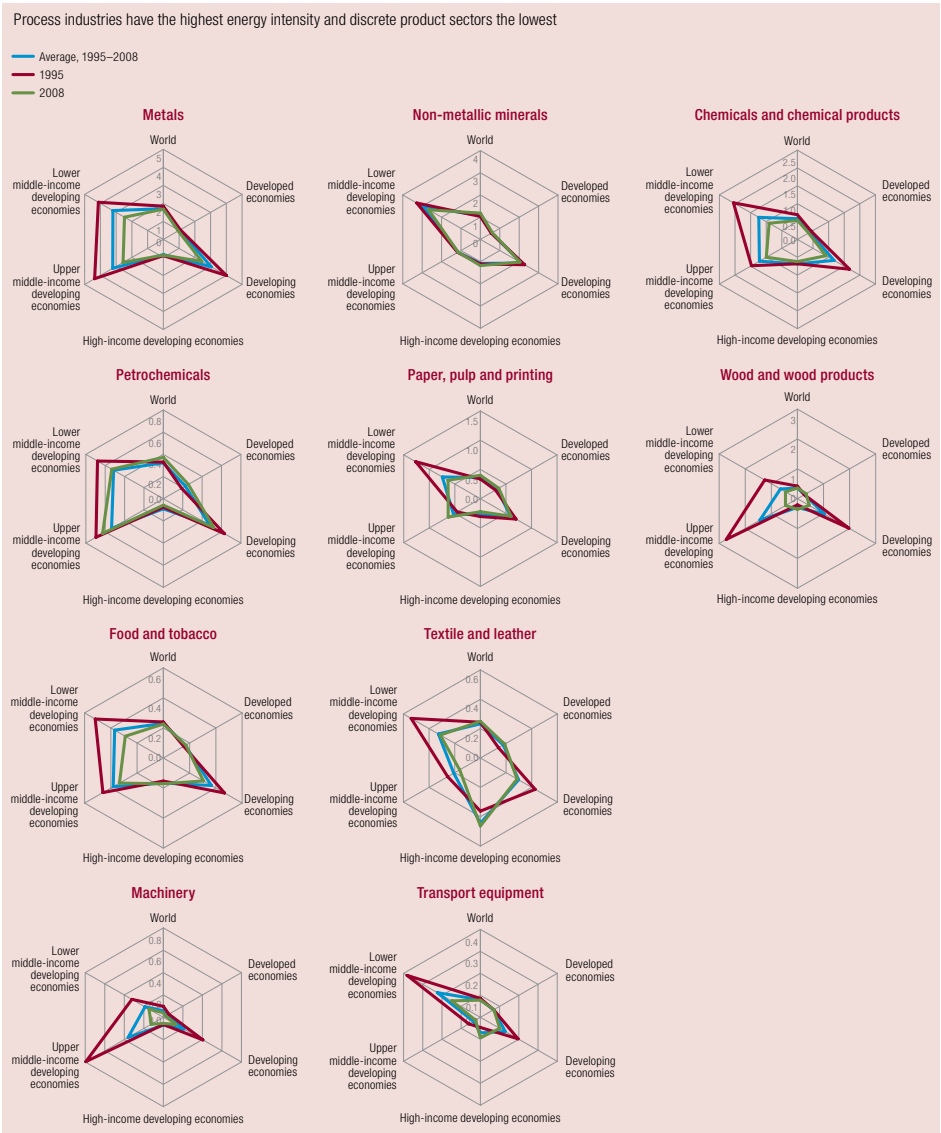
Figure 9.3: Industrial energy intensity, by income group, 1990–2008



Source: UNIDO, 2011d, p.27

UNIDO analysis drilled down further into the energy intensity of individual sectors between 1995 and 2008 (Figure 9.4). A number of trends emerge from this detailed UNIDO sectoral analysis. First, in general the processing industries such as metals, minerals and chemicals are considerably more energy-intensive than the assembly industries such as transport, and final consumer goods sectors such as textiles, leather, wood products, and food and beverages. Second, the lower-middle-income economies consume industrial energy intensively in most sectors, although the upperr-middle-income economies are also characterized by energy-intensive industrial profiles in metals, petrochemicals, food, tobacco and wood products. And third, with the solitary exception of non-metallic minerals, there was a marked reduction in energy intensity in lower- and upper-middle-income economies in all other sectors between 1995 and 2008. And third, with the solitary exception of non-metallic minerals, there was a marked reduction in energy intensity in lower- and upper-middle-income economies in all other sectors between 1995 and 2008.

Figure 9.4: Energy intensity, by industrial sector and income group, 1995–2008 (tonnes of oil equivalent per US$1,000 manufacturing value added, in 2000 prices)



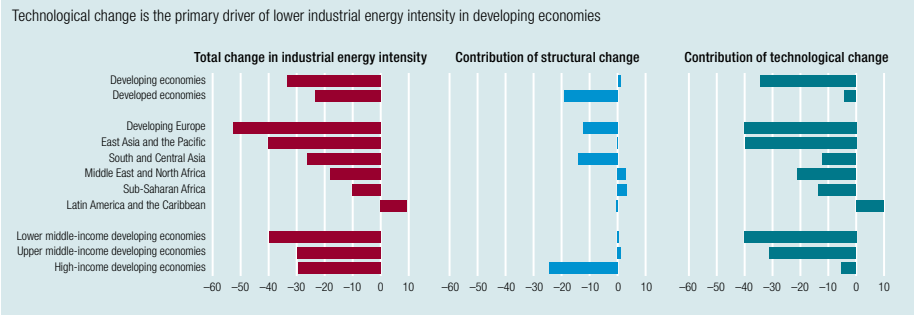
Source: UNIDO, 2011d, p.30

The determinants of improvements in the energy-intensity of production

In Chapter 4, discussing UNIDO's contributions to the understanding of structural change, a distinction was drawn between inter-sectoral and intra-sectoral change. Intra-sectoral change was largely a reflection of changes in technology, whereas inter-sectoral change reflected the balance of different sectors in aggregate production. A similar distinction can be applied to the analysis of the sources of reducing energy intensity. Using advanced decomposition analysis with the highest level of possible disaggregation available (62 economies and 11 sectors, between 1995 and 2008), the 2011 Industrial Development Report determined the balance between these two drivers of improvement (Figure 9.5). As a general conclusion, whilst technological change (intra-sectoral improvements) has reduced energy intensity in most economies, structural change (inter-sectoral shifts) has been the major source of improvement in the developed economies, in part reflecting the outsourcing of energy-intensive sectors and activities to lower-income economies. On a country or economy basis, several results stand out (see the 2011 IDR for more details, Figure 2.3):

- Industrial energy intensity fell in 52 of the 62 economies.
- Technological improvements contributed to declining industrial energy intensity in all economies except for Armenia, Chile, Colombia, Moldova and the United States.
- For 34 economies, structural changes favoured less energy-intensive industries; for 28 economies, it favoured more energy-intensive industries.

Figure 9.5: Components of change in industrial energy intensity, by region and income group, 1995–2008 (percent)



Source: UNIDO, 2011d, p.36

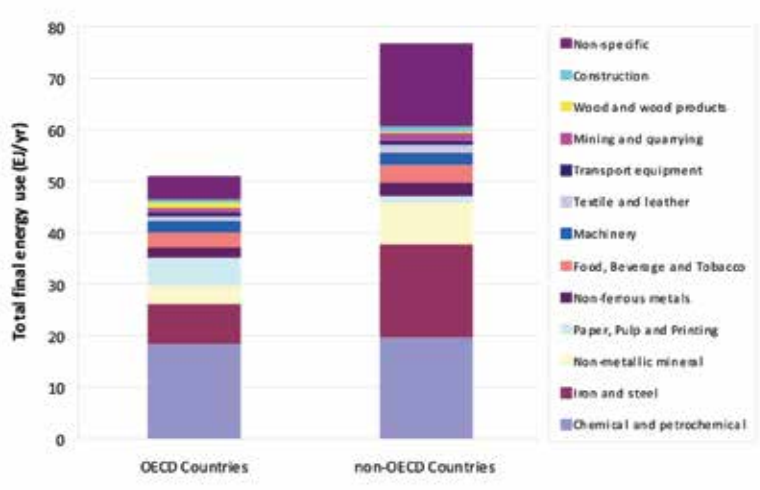
9.2. ISO 50001

Today industry accounts for more than one-third of global energy consumption and greenhouse gas emissions and will continue to drive the growth of global energy demand over the coming decades, particularly in developing and emerging economies. In order to decouple industrial development and economic growth from energy consumption and the associated environmental and climate change impacts, industry needs to substantially increase its energy efficiency and progressively switch from carbon-intensive to low-carbon and low-emission technologies.

While the challenge remains daunting, there are policies, technologies, best practices and other instruments available to industry, policymakers and the international community to support and undertake actions. The immediate need is to accelerate the global dissemination and implementation of existing best available technologies and practices. It is estimated that by doing so, industry could cut its global energy consumption by over 25 per cent.

Firms in developed countries are responsible for a large proportion of industrial final energy use worldwide, with approximately 40 per cent coming from OECD countries, as the below Figure represents (UNIDO, 2010c, p.1).

Figure 9.6: Sectoral breakdown of total final industrial energy use in OECD and non-OECD countries, 2007



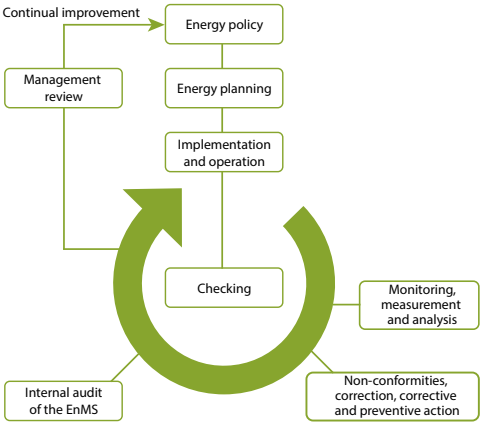
Source: UNIDO 2010c, p. 2

As a sector that is projected to account for the largest share of new global energy demand by 2035, industry has a critical role to play in the achievement of international sustainable development goals, including energy security and climate-change mitigation. Sustainable industrial development is particularly important in developing and emerging countries, which will require over 90 per cent of the new industrial energy demand by 2035. According to the International Energy Agency's World Economic Outlook Report (2013), the industrial sector holds 38 per cent of total potential energy savings in the future, which could be realized through the broad dissemination and application of best available practices and technologies.

Energy management systems (EnMSs) have emerged over the last two decades as a proven best-practice methodology to ensure sustainable energy efficiency and continually improve performance in industry. By scaling up the deployment of industrial energy management systems (EnMSs) and standards, UNIDO helps countries at all levels of development to improve the overall efficiency of their manufacturing sectors, while also achieving cost-effective reduction of greenhouse gas (GHG) emissions. Industry experience around the world has shown that companies can save around 10 to20 per cent of their annual energy consumption and reduce their costs through better energy management, often by just making operational changes with minimal or no investment.

Taking stock of the good results achieved through national EnMS standards in various countries, UNIDO developed the idea of an international EnMS standard in 2006. In UNIDO's view, an internationally recognized standard would be particularly helpful to developing countries and economies in transition that still lack policy frameworks and mechanisms to promote and achieve improved energy efficiency in the industrial sector. UNIDO initiated the process that subsequently led to the publication on 15 June 2011 of the international standard ISO 50001:2011, energy management systems, along with its partners in ISO and ITU.

Figure 9.7: EnMS model for ISO 50001



Source: UNIDO Brochure. The UNIDO Programme on Energy Management System Implementation in Industry. Retrieved from https://www.unido.org/fileadmin/user_media_upgrade/What_we_do/Topics/Energy_access/11._IEE_EnMS_Brochure.pdf

ISO 50001 specifies the requirements for establishing, implementing, maintaining and improving an energy management system, whose purpose is to enable an organization to follow a systematic approach in achieving continual improvement of energy performance, including energy efficiency, energy security, and energy use and consumption. The standard aims to help organizations continually reduce their energy use, resulting energy costs and greenhouse gas emissions.

The elaboration and implementation of ISO 50001 has been especially important with respect to SMEs, who make up a substantial proportion of any economy but who are often under-resourced and lack relevant knowledge with respect to international environmental standards. Energy costs are very often a significant part of an SME's budget. Managing and using energy efficiently can contribute to substantial gains over time. While individual SMEs have a relatively small energy consumption, their efficiency improvement potential is usually much higher than that of large energy consumers. Considering the high number of SMEs in any economic sector or supply chain, collective efficiency improvement measures can have a major impact on energy costs for the sector and the nation at large, as well as substantial beneficial effects on the environment.

To trigger interest in energy efficiency and with a view to helping SMEs take action to overcome many of the barriers that prevent them from implementing practical measures and saving energy, UNIDO collaborated with ISO and ITC to prepare "ISO 50001: Energy management systems — a practical guide for SMEs". This guide helps

SMEs understand the requirements of the ISO 50001 standard for energy management systems, become familiarized with the main components of such systems and acquire the skills needed to identify and implement concrete energy efficiency improvement measures.

Aghajanzadeh et al. (2016) have estimated the long-term outcomes of implementation of the standard at the global level, calculating energy, costs, and CO_2 emission savings for the year 2030 assuming a 50 per cent uptake by industrial and service sectors. The Figure below presents results estimated for impact of ISO 50001 EnMS globally in the year 2030. Results include annual and cumulative energy, cost, and CO_2 savings for the industrial and service sectors independently and in aggregate. A contextual value of equivalent number of passenger vehicles is available only in an annual basis.

Neither has the overall impact of the standard been observed merely at the macro level; several early private sector adopters of ISO 50001 reported significant reduction in their energy consumption, most notably one firm which reported a reduction in power consumption of 10 MWh in one calendar year (Steele, 2012).

9.3. UNIDO and the environment

The Brundtland Commission (1987) argued that sustainable development can be achieved both in the North and in the South, ensuring "that development meets the needs of the present without compromising the ability of future generations to meet their own needs". The ensuing interest in environmental issues led to the holding of the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992, which approved Agenda 21 and three conventions on climate change, biodiversity and desertification. This also led to new normative functions of UNIDO such as the Montreal and Kyoto Protocols that had been suppressed during the cold war. Since then, UNIDO's environment- and energy-related activities have historically spanned a wide range. UNIDO's ground-breaking role in implementing the Montreal Protocol, setting up a global network of cleaner production centers and in enforcing green industries has generated a plethora of ideas on how to promote environmental sustainability.

9.3.1.The Montreal Protocol

Scientific concerns about damage to the ozone layer encouraged governments to adopt the Vienna Convention on the Protection of the Ozone Layer in 1985, which established an international legal framework for action. In 1987, countries adopted a

legally binding commitment in the Montreal Protocol on Substances that Deplete the Ozone Layer, which required industrialized countries to reduce their consumption of chemicals harming the ozone layer.

The new market requirements derived from those agreements, forced developing countries enterprises to adjust production processes in order to remain competitive, meaning reducing and eventually phasing out completely production of ozone depleting substances (ODS). UNIDO had been observing and researching developments in the field and when the declaration emerged it was clear that the Organization would play a substantial role as one of the implementing agencies of the Montreal Protocol. UNIDO is involved in assisting with strategic planning, policy formulation and technical support in project identification, preparation and implementation, helping developing countries to meet their treaty obligations with sectoral programmes for phasing out ODS in the manufacturing and agricultural sectors.

Figure 9.8: Screenshot of the numerical Results section of the IET50001 worksheet

Year	Sector	Total Annual Savings				Cumulative Savings		
		Primary Energy [EJ]	Cost [2015 $US B]	Emissions [MtCO2]	Passenger Vehicles [Million]	Primary Energy [EJ]	Cost [2015 $US B]	Emissions [MtCO2]
2030	Industrial	10.37	$ 53.3	721	152	63.3	$ 349.9	4,399
	Service	5.47	$ 43.1	316	67	41.61	$ 354.7	2,402
	Total (I&S)	15.85	$ 96	1,037	218	104.9	$ 704.6	6,801

Source: Aghajanzadeh et al., 2016

9.3.2. Cleaner Production

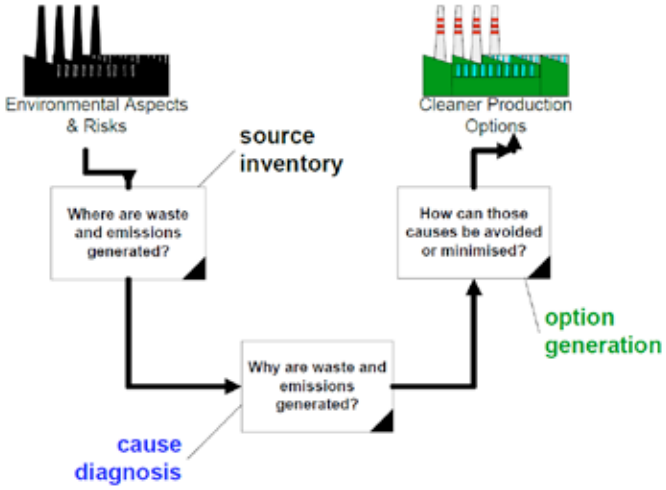
In the mid-1980s industrialized countries started to put forward a preventive approach in terms of environmental concerns in manufacturing and related sectors. It was considered that preventing the generation of waste and emissions in industry made more sense than trying to recycle, recover and treat wastes and pollutants once created or already discharged into the environment. Early experiences revealed that this could also be achieved without compromising profits, as enterprises reported cost savings from preventing pollution.

In 1992, Chapter 34 of Agenda 21 endorsed by the UN Conference on Environment and Development in Rio called on international organizations, including United Nations agencies, to "promote, facilitate and finance as appropriate, the access to and transfer of environmentally sound technologies (ESTs) and corresponding know-how, in

particular to developing countries…" (United Nations, 1992). Against the background of the preparations for the Rio Conference, the realization came that if manufacturing was to go global, cleaner production should follow suit as a global undertaking.

An agreement was reached on a strategy for worldwide promotion of CP by UNIDO, with its industrial expertise, in cooperation with UNEP, with its environmental expertise. UNIDO adopted the UNEP definition of cleaner production, which is "the continuous application of an integrated preventive strategy to processes, products and services, to increase efficiency and reduce risks to humans and the environment". Cleaner production and resource efficiency were intrinsically linked, as since the World Summit on Sustainable Development in Johannesburg 2002, sustainable consumption and production patterns have been put forward as a way to respond to the increasing scarcity of limited resources such as water and fossil fuels. UNIDO saw CP or its operational equivalents, such as pollution prevention, resource efficiency and waste minimization, as an opportunity for promoting win-win solutions for manufacturing companies to reduce their operational costs by using less energy, water and raw materials and simultaneously diminish environmental liabilities by generating less waste and pollutants (Luken, 1994).

Figure 9.9: Cleaner production cycle



UNIDO Resource Efficient and Cleaner Production thinking applies preventive environmental techniques and practices, and total productivity management to improve resource productivity, reduce environmental impact and protect human health and well-being. In terms of decoupling resource consumption from production,

enterprises are encouraged to adopt business strategies to maximize resource efficiency and cleaner production, also called “three Rs” strategies — reduce, recycle, and reuse. UNIDO has assisted countries with the adaptation and adoption of resource-efficient and cleaner production (RECP) methods, technologies and systems by enterprises and other organizations. With RECP strategies, resource efficiency and pollution intensity are turned into performance areas for management and staff that can be routinely monitored with relevant indicators.

Resource efficiency/clean production indicators

Resource productivity	Pollution intensity
Productive output per unit of resource consumption	Waste and emission generation per unit of productive output
• Total materials use	• Waste quantity
• Total energy use	• Air emissions
• Total water use	• Waste water volume

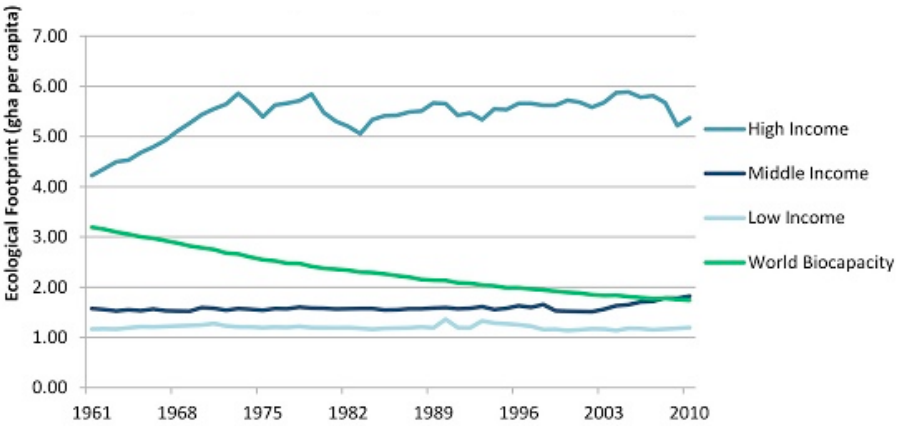
The early initiatives in the field of cleaner production and resource efficiency had convincingly demonstrated by the mid-1990s that cleaner production was equally applicable and beneficial in developing and transition countries as it had been in industrialized countries. However, further adaptation and wider adoption of cleaner production required national capacity and expertise. Then, the concept of National Cleaner Production Centres (NCPCs) was born. The first eight NCPCs opened in 1995. Their achievements sparked global interest and additional NCPCs were established, with the support of UNIDO and UNEP. UNIDO cleaner production approach involves the systematic root source and cause analysis to guide the identification, evaluation and implementation of resource efficient and clean production opportunities.

Figure 9.10: Cleaner production center throughout the years

9.3.3. Green Industry

Unsustainable production and consumption patterns, driven by rising population and wealth levels, test the limits of the planet's resources and its assimilative capacity for emissions. Although manufacturing activities are the engine of the global economy, particularly in developing countries, uncontrolled industrialization may cause or potentially increase the effect of climate change, loss of biodiversity, land degradation and desertification, air pollution, surface and groundwater pollution, and chemical contamination.

Figure 9.11 Ecological footprint by World Bank income groups

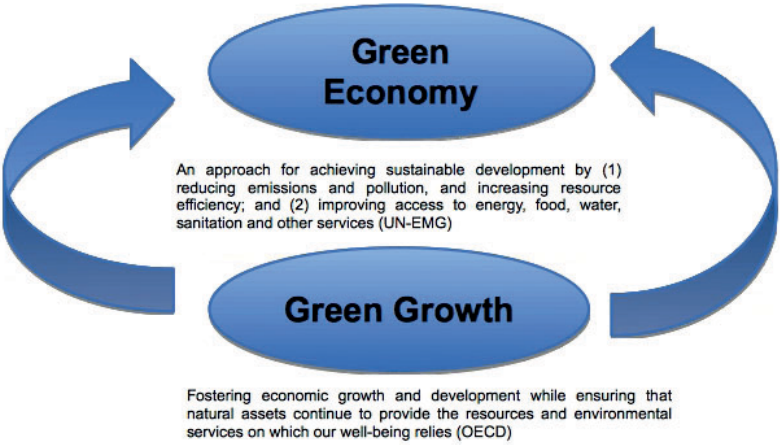


Source: Global Footprint Network. Retrieved from http://www.footprintnetwork.org/

As we already mentioned, one of the main global challenges is decoupling economic growth from the use and consumption of natural resources and energy. This means providing more value with less environmental impact and better economic and ecological efficiency. While labour productivity has increased markedly in line with technological advances over the past 50 years, resource productivity has seen only a marginal increase. Similarly, technological progress has been viewed primarily in relation to labour productivity. Limited focus has been placed on technological innovation to promote resource efficiency. UNIDO's answer to question of how enterprises in developing countries could become greener and shrink their environmental footprint, while at the same time continuing to grow and deliver goods, services and jobs to their populations, was the concept of green industry. Green industry is a sector-strategy for the realization of green economy and green growth in the industry sector.

Green industry is operationalized by scaling-up and mainstreaming proven methods and practices for reducing pollution and resource consumption in all sectors ("greening of existing industries") and expanding the supply of affordable, appropriate and reliable environmental goods and services ("creating new green industries"). Green industry also promotes de-materialization of the economy by reducing the material footprint of processes and products, through new business models, eco-design of products and closing the material loop by promoting a circular economy. It also fosters a shift from labour to resource productivity by re-orienting the prevailing economic paradigm away from an emphasis on achieving labour productivity, towards maximizing productivity gains from efficient resource management.

Figure 9.12: Green economy and green growth



Where there is a lack of a regulatory environment, enterprises tend to externalize costs associated with generating waste and pollution to the rest of society. Therefore,the greening industries require a strong political commitment and policy leadership from influential sectors within the government, and supporting leadership throughout the public sector. From a public policy perspective, the greening of industries is a cross-cutting exercise, which traverses a range of policy streams. These include industrial policy (e.g. technology development), environmental policy (e.g. resource conservation measures), and regional development policy (e.g. provision of local infrastructures).

As part of its policy support work, UNIDO has assisted governments to put in place the necessary legal and regulatory infrastructure to establish incentives to promote green industries, enforce mechanisms to ensure compliance to environmental standards and introduce sanctions for polluters.

Figure 9.13: Green policies

Economic	Regulatory	Information	Cooperation	Education& Research
• Environmental Taxes • Fees and other charges • Certificate trading • Environmental Financing • Green public procurements • Subsidies	• Norms and standards • Environmental liability • Environmental control and enforcement	• Eco-labeling • Sustainability reporting • Consumer advice services • Information centres • Environmental quality targets & environmental monitoring	• Voluntary agreements • Technology transfer	• Research & development • Education & training

BOX 9.1: "TRANSFER OF ENVIRONMENTALLY SOUND TECHNOLOGIES" – TEST METHODOLOGY

In 2000, UNIDO designed the Transfer of Environmentally Sound Technologies (TEST) integrated approach. The approach is part of UNIDO activities to assist developing countries and countries with economies in transition with the transfer of best available environmentally sound technologies and environmental practices to **improve water productivity in industry** and **prevent discharge of industrial effluents into international waters** (rivers, lakes, wetlands and coastal areas) thereby protecting water resources for future generations. The TEST approach was piloted in the industrial hot spots of the Danube River Basin and since then, it has been replicated in several industrial hot spots worldwide.

The TEST approach integrates and combines essential elements of tools like resource efficient and cleaner production (RECP), environmental management systems (EMS), environmental management accounting (EMA), and corporate social responsibility based on an integral analysis of the needs of an enterprise. The integrated approach prioritizes a preventive strategy and considers the transfer of additional technologies for pollution control only aft er RECP solutions have been explored. It addresses the managerial aspects of environmental management as well as its technological aspects, by introducing tools such as EMS and EMA and places environmental management within the broader strategy of environmental and social business responsibilities, by leading companies towards the adoption of sustainable enterprise strategies.

Source: Transfer of Environemtal Sound Technologies. Retrieved from http://recpnet.org/wp-content/uploads/2016/05/Transfer-of-Environmentally-Sound-Technologies.pdf

9.4. Win-win outcomes: a reduced environmental footprint, enhanced profitability and cost-reduction

Much of the resistance to mitigating climate change arises from the widespread perception that the adoption of environmentally-friendly technologies will lead to a reduction in incomes. One of the problems with these objections is the narrow specification of "incomes". These are measured in terms of access to commodities (for example, automobiles) and services (for example, tourism) with little consideration of the environment in which these products are consumed (increasing traffic density means that many cars are locked in traffic jams for much of their lives; the fruits of low-cost tourism can easily be spoiled by pollution). Another problem with objections to the reduction of energy utilization is one of time-preference; that is, the costs of energy displacement today will not be felt until some time in the future.

Yet, not all objections to the introduction of energy-efficient production can be brushed off easily. There are situations where more environmentally-efficient industrial production systems raise the pecuniary costs of production. There may be a trade-off between lower energy utilization and the standard of living, however broadly this standard of living is defined. Hence a large component of the technological effort put into innovation processes seeks to produce technologies with win-win outcomes: the introduction of technologies which are simultaneously environmentally friendly and cost-saving. Identifying and illustrating the range and extent of win-win outcomes has the capacity to play a major role in persuading policy makers and citizenry to adopt more environmentally-friendly production systems and consumption patterns.

Table 9.1: Improved energy production practices in Tunisia

Company	Size (*)	Investments [USD/yr]	Savings [USD/yr]	Water Savings [%]	Energy Savings [%]
Food & Beverage Sector					
Générale Industrielle Alimentaires Slama (GIAS)	493	191,200	133,700	12	17
Société de Conserves Alimentaires du Cap Bon	50-250	98,139	73,639	44	9
Tunisie Lait	308	827,410	746,638	16	13
Société de Boissons du Cap-Bon (SBC)	119	56,331	75,454	22	21
Societè Nouvelle de Boisons (SNB)	202	29,200	194,600	12	14
Centrale Latiere du Cap nord (CLC)	547	484,945	546,903	13	19
Textile Sector, Finishing					
Teinturerie et Finissage Mediterraneenne (TFM)	55	1,264,645	491,860	56	10
Gartex	185	76,200	67,200	19	15
Megastone	150	76,500	55,600	10	30
Traitex	60	181,800	111,836	19	39
Garment Dyeing Service	80	139,000	91,300	24	7
Star Wash	40	37,500	28,000	30	14
Leather Sector, Tanneries					
Tanneries Megisserie du Maghreb (TMM)	180	523,000	446,800	14	15
Société Moderne des Cuirs et Peaux (SMCP)	35	287,000	97,200	22	3
Tannerie du Nord Utique (TNU)	50	184,000	125,000	8	70
TOTAL		4,456,870	3,286,530		

(*) n. of employees, 2009

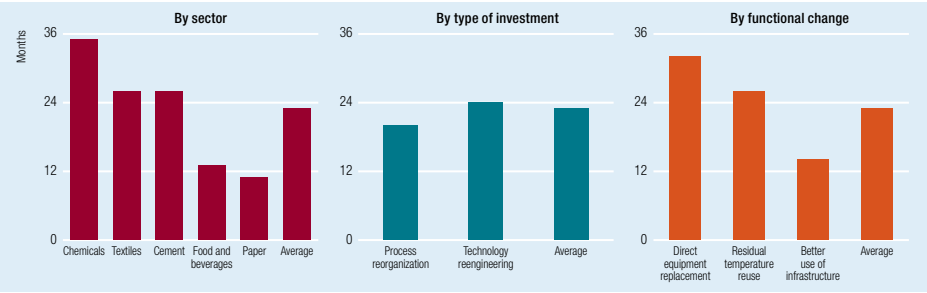
Estimated Environmental Benefits

Water Savings [m³/yr]	**Energy Savings** [MWh/yr]	**BOD5 Reductions** [tons/yr]	**COD Reductions** [tons/yr]
650,00	25,083	1,610	2,762

Source: UNIDO, 2012b, p.15

Additional evidence of win-win outcomes arises from a survey of 357 firms in a range of industrial sectors in 25 developing economies conducted for the 2011 IDR. The total value of investments in environmental efficiency projects in these firms was US$614 million, with a wide range of project costs (ranging from US$100 to US$73). These investments included equipment replacement, water reuse, residual energy reuse, improved insulation, and better use of infrastructure and fuel optimization. Figure 9.14 shows the short payback periods of these investments, distinguishing between sectors, type of investment and functional change.

Figure 9.14: Payback period of UNIDO sample of industrial firms investing in energy efficiency



Source: UNIDO, 2011d, p.78

9.5. Environmentally-friendly industrial development: case-study evidence from Kenya and Nigeria

What is the extent of adoption of energy efficient technologies in the agro-processing sector in developing economies, and what determines the rate of their diffusion? UNIDO's recent detailed investigation of two sectors, which involve low income farmers and small scale processors and produce basic consumption goods for low-income consumers, throws light on these factors. The study involved 22 renewable energy supplying firms and 62 cassava-processing firms in Nigeria, and 41 renewable energy supply firms and 40 maize-processing firms in Kenya.

The findings of the study revealed that the diffusion of renewable energy and energy efficiency technologies in Africa and other developing economies is largely dependent on existing government policies and regulatory conditions, and these do not effectively promote the greening of industry. The evidence from this study also confirms that market for renewable energy and energy efficient technologies in Africa is relatively underdeveloped. Some of the key findings of the study are outlined below.

Sources of renewable energy technologies

The renewable energy technology sectors are young and growing in the two countries. Solar and biomass are the two dominant technologies. Solar PV is based on foreign technology whereas biomass predominantly draws on domestic technology and know-how (Figure 9.15). The primary source of imported renewable energy and energy-efficient technologies is China, and to a lesser extent, India (Figures 9.16 and 9.17).

Figure 9.15: Main sources of manufacturing equipment

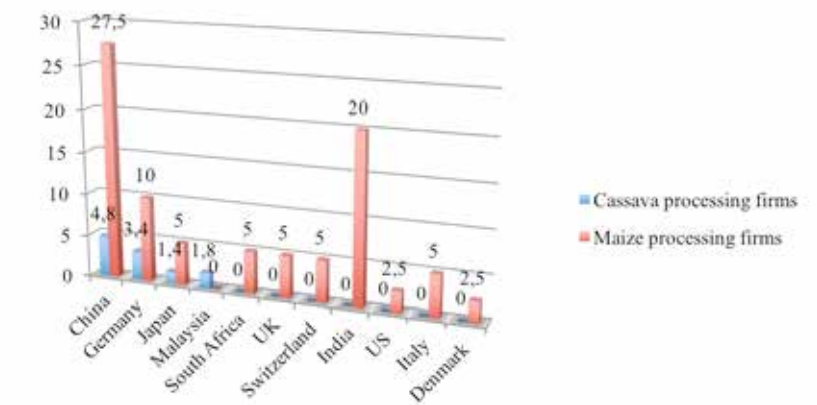
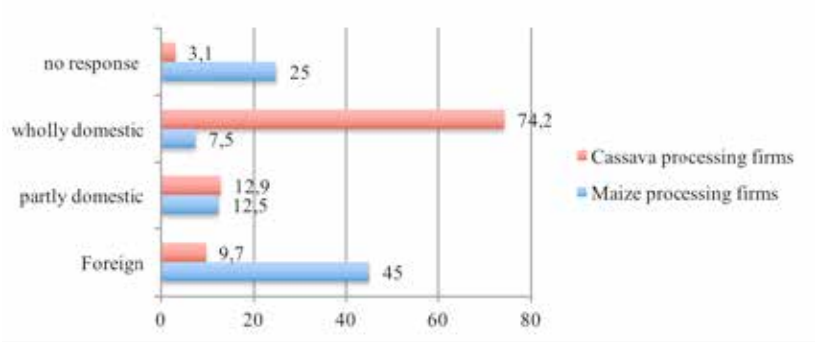
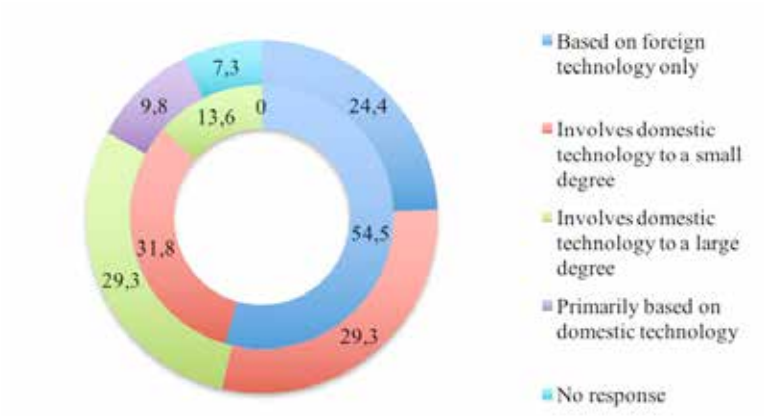


Figure 9.16: Source of energy efficiency technlogy used



Source: UNIDO and UNU-Merit, 2014, p. 75

Figure 9.17: Development of technology content of RETs sold by the respondents (in %, inner ring: Nigeria, outer ring: Kenya)



Source: UNIDO and UNU-Merit, 2014

Facilitators and barriers to adoption

The major drivers of energy-efficient technologies were similar in both countries. The critical success factors were in-house knowledge about energy management, availability of technical expertise, and the desire and need to save costs.

Energy costs are a significant cost item for many agro-industrial sectors but few companies have adopted sophisticated energy-efficient production measures. The main reason for this which emerges from the study is that the system of innovation promoting the development and diffusion of energy efficiency in both economies is weakly developed.

The major factor facilitating the sale of renewable energy technologies, particularly in Nigeria, is the unreliable and sporadic power supply. In Kenya, the volatility of the foreign exchange rate acts as a positive stimulus for renewable energy technologies deployment as changes in the exchange rate affect the electricity utility costs. “Unfavorable business climate/environment for FDI and high tariffs” and the “lack of technical competence on the part of potential adopters” proved to be the two most important barriers to the adoption of renewable energy technologies in both countries (Table 9.2).

Table 9.2: Barriers to the adoption of renewable energy technologies

Nature of barriers*	Nigeria		Kenya	
	Frequency	Percentage	Frequency	Percentage
Government's preference for local equipment	2	9.1	0	0.0
High-tariffs on foreign equipment	15	68.2	6	14.6
Unfavorable business climate/environment for FDI	16	72.7	10	24.4
Lack of technical competence on the part of potential adopters	10	45.5	7	17.1
Language / different culture	1	4.5	1	2.4
Product offerings from foreign suppliers do not completely fit with needs of African companies	4	18.2	0	0.0
High cost of technology	6	27.3	0	0.0
Fake products (RETs)	0	0	0	0.0
Importance of government policy as a barrier to RETs adoption	Frequency	Percentage	Frequency	Percentage
Not a barrier	0	0.0	25	61.0
Only a minor barrier	12	54.5	4	9.8
A major barrier	10	45.5	12	29.2
Total	22	100	41	100

Source: Luken, 2009, p.85

CHAPTER 10
INDUSTRIAL POLICY AS A PROCESS: BRIDGING THE DIVIDE BETWEEN THE PUBLIC AND PRIVATE SECTORS

As Chapter 2 noted, the five decades of UNIDO's existence have seen a see-sawing between the state and the private sector as the drivers of industrial development. During the 1960s and 1970s state-directed industrialization was the general rule in developing economies. To varying degrees, it comprised a mix of trade protection, sectorally-directed investment and direct state ownership in the productive sector. The counter-revolution of the 1980s, 1990s and early 2000s swept away the primacy of the state in industrial development. Trade restrictions were rapidly removed and the challenge of industrial growth was left to an unhindered private sector, within which FDI was given a prime role.

Five decades after UNIDO's establishment, "best-practice" thinking on industrial policy has become more nuanced, seeking to bridge the divide between the public and private sectors in promoting industrial growth. In order to understand why this has occurred and how this is reflected in UNIDO's contribution to knowledge and practice, it is necessary to begin by examining UNIDO's industrial masterplans.

10.1. Industrial planning – the Malaysian masterplan

In the 1960s, 1970s and early 1980s, UNIDO's approach to industrial policy was based on economic planning methodologies and the production of industrial masterplans.

In addition to the perspectives mentioned in earlier chapters, UNIDO's thinking in its early days was also influenced by the Mahalanobis model, developed by the Indian statistician Prasanta Chandra Mahalanobis. Essentially, this was a two-sector model aimed at promoting industrial development by shifting the pattern of industrial investment towards building up a domestic consumption goods sector. Achieving a high standard in consumption first required investing in the production of capital goods. The two-sector growth model was a variant of the Leontief input-output model and similar to the Feldman model, which had been used by the Gosplan, Soviet Union's planning commission.

The industrial masterplans of the time were attuned to a then dirigiste attitude by the policy-makers although were quite flexible to accommodate the diverse perspectives prevailing within UNIDO. Typically based upon a series of sectoral studies, they provided a highly technical map of the manufacturing industry and its development prospects in accord with the prominent share of the public sector in productive activities and the ensuing protectionist syndrome; they hardly tackled the issues of competitiveness, foreign investment, and private sector in general. Yet they were instrumental in setting the stage for a massive drive towards industrialization whenever governments had the means to realize their ambitions: an example is the first Industrial Master Plan of Malaysia, produced in 1985 with UNIDO assistance (Scholtes, 1999, p.11).

The plan had the objective to assist the Government of Malaysia in identifying priorities for industrial development. The priorities were to be determined on the basis of each sub-sector's real and prospective contribution to the Malaysia economy. UNIDO assisted Malaysia in generating a considerable amount of data for monitoring the economic performance of each industry so that strategies and policies could be revised and modified to accomplish the goals set out by the government.

The Malaysian Government was very keen on crafting entire "reform packages" instead of introducing single sequential policies. The industrial master plan prepared by a research team at the Malaysian Industrial Development Authority (MIDA) with technical assistance from UNIDO produced two sets of output: an industrial sectoral development plan consisting of specific development objectives, strategies and policy programmes for each of the major manufacturing sectors; and a set of special study reports on supporting development policies and issues such as resource assessment, linkage effects, industrial institutional infrastructure, incentive policies, industrial manpower assessment and development strategy. The inputs were incorporated into the Fifth Malaysia Plan (1986-1990).

Prior to 1970, in Malaysia policies aimed at reducing dependence on rubber and tin, considering high commodity price volatility and the anticipation of declining prices following the development of synthetic rubber. Although some import-substitution industrialization was promoted, tariffs were moderate as the focus was on agriculture and rural development. The creation of the Malaysian Industry Development Authority (MIDA) and the adoption of the Investment Incentives Act preceded the launch of the new economic policy (NEP) in 1970, aimed at transforming the economic structure and improving income distribution in 20 years. SMEs and FDI in export-oriented firms were promoted. Low-skill, labour-light manufacturing activities, such as textiles and garments and assembly of electronic components developed in export-processing zones. Intervention was via licensing, quotas and regulated prices. Faced with an economic slowdown in the early 1980s, the government turned to public sector investment in heavy industries (cement, iron, paper, petrochemicals and automotive) to fuel growth and create stronger linkages in industry (UNIDO, 1991a).

Targeted policies fostered transformation of a natural resource dependent economy into a diversified economic structure based on processed natural resources, high-value manufacturing industries such as consumer electronics, industrial automation and heavy industries and services. UNIDO was very active in assisting the Malaysian Government in this endeavour. Apart from assisting MIDA in developing the Industrial Master Plan 1986-1990 as part of its technical cooperation and policy advice function, UNIDO contributed by developing specific objectives, strategies and policy programmes for major manufacturing sectors. Assistance was also provided in preparing a set of special study reports on linkages, industrial institutional infrastructure and industrial incentive policies and development strategy. All these measures provided the basis for blueprints and agendas for action to be incorporated in the policies, strategies and programmes of the fifth Malaysia plan.

Globally, in the late 1980s the international system was witnessing a series of convulsions with the gradual dissolution of the Soviet Union heralding a unipolar international order. There were, inevitably, ramifications for industrial development, given the newly-straitened circumstances of a global power that was also a strong advocate of autarchy, import substitution and protectionism. It was also evident to many economists that the hitherto prevailing paradigm for many developing countries had been largely unsuccessful, with several entering structural readjustment programmes in the 1980s to alleviate excessive deficits. As Stiglitz et al. (2013) remark:

"The 1960s and 1970s were marked by interventionist government policies to promote economic nationalism and development in many of the developing countries. It is

evident that the market economy—so far as it existed under colonialism—had not resulted in development. There were many motivations for the establishment of state-owned firms: a shortage of private firms, the lack of depth of local (private) capital and financial markets able and willing to finance new enterprises or the expansion of old ones, the inability of local enterprises to bear the risks of large-scale investment, a fear of exploitation by foreign firms — typically from the colonizing countries that had previously exploited them so badly, and intellectual currents fashionable at the time (understandable in the aftermath of the Great Depression) that emphasized the limitations of markets. Interestingly, it was in the same period that economic theory came better to understand "market failures", the many instances of which profit-maximizing firms do not lead to economic efficiency or societal wellbeing." (Stiglitz et al., 2013, p.3)

In many countries subject to such programmes, manufacturing was no longer viewed as a necessity for increasing growth rates, and the attractiveness of the import-substitution model declined dramatically. Developing countries saw their fragile economies exposed to outside competition and their domestic consumption reduced significantly. Manufacturing thus declined across much of the developing world.

By 1991, a National Development Policy (NDP) had replaced NEP in Malaysia. NDP began reflecting the thinking of the time, but only partially. The focus remained on the achievement of growth with equity and attaining a balanced sectoral and regional development that relied strongly on the private sector. Amid increasing trade liberalization, the government introduced a structural tax reform to increase Malaysia's international competitiveness. It also launched the Multimedia Super Corridor (MSC) in 1996 to develop a knowledge-based economy. This stage has seen a consolidation of manufactured exports and an evolution towards high-technology electronics manufacturing, facilitated by the existence of a highly skilled English-speaking population. By the year 2000, Malaysia's manufacturing exports accounted for 80 percent of its total exports.

10.2. From masterplans to private sector development and microeconomic efficiency and sustainability

The perception of industrial policy within and beyond UNIDO experienced several pendulum swings over time; from widespread acceptance during phases of import-substituting industrialization in the 1960s and 1970s to outright rejection during

the 1980s and 1990s. Developed countries usually adopted a pragmatic stance and maintained a certain level of proactive policies to foster the competitiveness of their industries, while seeking to avoid highly market-distorting bureaucratic interventions. In contrast, many developing countries followed the respective ideological mainstream, adopting radical policy changes. In the 1960s and 1970s most developing countries' governments (especially in Africa, Latin America and South Asia) heavy-handedly intervened in markets with the aim of building national industries. The late 1980s and 1990s witnessed the dismantling of protective trade policies and selective economic promotion under the hegemony of neo-liberal orthodoxy. Accordingly, in the 1990's UNIDO was trying to find a "middle way" between promoting industrial policy and the Washington Consensus.

The mid-1990s also witnessed a number of internal convulsions in the Organization, most notably the withdrawals of Canada, the United States and Australia. These endogenous shocks bore some fruit in the shape of the business plan, which not only outlined the scope of future activities and structures, but also gave prominence to private sector support services, notably promotion of investment and related technologies (Margariños, 2005, p.177). This signified a transition in the delivery of UNIDO services, which shifted increasingly from supporting the public sector to the promotion of private investment and entrepreneurship, and in some cases even supporting privatization efforts directly.

The upshot form these international and organizational developments was that from an originally authoritative stance, the masterplans turned indicative and served primarily an analytical, as opposed to prescriptive, purpose. By then governments were facing severe resource constraints, which curtailed their capacity to intervene in the economy as investors and producers. On the contrary, the first systematic attempts to contain external and internal deficits imposed drastic restructuring efforts on them and gave room for a growing role of the private sector. The "Plan Directeur d'Industrialisation du Cameroun" elaborated in the end of the decade provided significant stake of private enterprises in the country's industrial development.

Indeed, from authoritative to indicative and later to interactive, the making of industry policy became reactive, or responsive, to market signals. The public authorities increasingly targeted their resources and policy instruments at market deficiencies hampering the spontaneous rise of private ventures. Consequently, economic development was often found to crystallize at the sub-level of regions, where private firms and local governments formed a closer community of interests and offered grounds for a more effective co-operation. Since the mid-90s, UNIDO has been

increasingly involved at such level, in the Red River Delta region of Viet Nam, the Sumgait region of Azerbaijan or the Jingjiu corridor in China (Scholtes, 1999, p.12).

With the loss of the state primacy in industrial Development, UNIDO strategic plans had a much smaller scale, dealing basically with specific sectors. The UNIDO assistance in Cote d'Ivoire, for example, although it was still called a master plan,took a very different approach. It supported the inception of the National Enterprise Restructuring and Upgrading Programme (PNRMN), which targeted a sample of 25 Ivorian enterprises. This was one of the first restructuring and upgrading programmes in the region with the objective of helping businesses to successfully face the challenges of the upcoming market liberalization in the context of the Economic Partnership Agreements (EPAs) with the European Union.

Moreover, UNIDO elaborated a series of sectoral masterplans in diverse countries. For example, UNIDO prepared the sector master plan in collaboration with the then Ministry of Trade and Industry in Ethiopia. The collaboration between UNIDO and the Ministry from 2005 onwards resulted in two documents, a master plan and a business plan for the leather and leather products sector. The master plan emphasized the need for the tanning industry to continuously improve both the value addition and the quality of the inputs supplied to the leather goods industry, including the footwear sector. It also introduced the technical benchmarking of the Ethiopian leather and leather product industry against more technically advanced leather industries.

In a further step down the same road, private sector firms were invited to take an active part in the implementation of an industry strategy from the very outset of its design. An industry strategy was a particular course of action no longer to be merely planned, but to be effectively managed in a business-like manner. The approach of strategic management of the industrial development was based upon extensive mechanisms of consultation between the Government and industry; through consensus building, both sides would agree on common objectives, joint strategies and a regular monitoring system. The "Schéma Directeur d'Industrialisation de la Côte d'Ivoire" completed in the early 1990 was the most comprehensive application of this new approach.

In addition to a much more dominant role of the private sector in industrialization, ideas of competitiveness, productivity and efficiency at the micro-level began to become rampant at UNIDO. Prior to the late 1980s, general economic studies of developing countries and selection of industrial sectors to be developed,in accordance with the comparative advantage enjoyed by a particular country, were mostly based on economy-wide models, including the concept of aggregate consistency, input-output, semi-input-

output and linear programming models, the Bruno measure and the effective rate of protection scheme. However, these models contained significant drawbacks insofar as they merely provided planning tools or analytical frameworks rather than a precise portrait of the wider economy, due to assumptions such as perfect competition, technical problems of aggregation, the need to assess the "control area" of the Government and the Corden restrictions. The aforementioned models also suffered from limitations in terms of their assessment of the overall ability of a country to compete in world markets, and provided little direct guidance to manufacturing firms already facing intense market competition (René-Dominique and Orall, 1986).

Due to several factors—including a lack of production capacity by firms in developing countries, issues relating to standardization, a series of failures by firms from developing countries attempting to access OECD markets, and a marked preference by donor countries for export-oriented strategies— policy thinking at UNIDO switched to address microeconomic problems. UNIDO observed that improvements in performance by firms from developing countries were linked to a relative total-factor productivity growth and favourable share-weighted rates of decrease in developing country input costs, rather than to "open door policies" as in the OECD countries.

UNIDO thus developed some models, based on the concepts of system efficiency and cost effectiveness, to assess and reduce the X-inefficiency of firms. This offered a number of advantages over previous models, most notably:

1. By distinguishing between internal and external factors, there was a clear indication of the manner in which data should be gathered, processed and used in formulating a competitive strategy;
2. The model allowed ranking of the position of a given firm relative to its competitors in any given foreign target market, or in a number of overseas markets;
3. It was then possible to pinpoint strong and weak areas of operation, thus producing essential information for better management;
4. Identification of the extent and nature of change in the competitive performance of firms;
5. Extension of sectoral ex-post analyses of government interventions to protect infant industries by at least providing the necessary conditions for justifying such interventions. (René-Dominique and Orall, 1986, p.3)

Subsequent work in this cadre, albeit at a more aggregate level, yielded the UNIDO Competitive Industrial Performance Index, which benchmarks national industrial performance of 118 countries on an annual basis using indicators of an economy's

ability to produce and export manufactured goods competitively.

Another question that UNIDO's industrial policy thinking began to confront is what type of industrial policy is necessary to assist countries diversifying from commodity-based sectors into higher value-added industrial activities. An early example of the work done in this direction is "INDUSTRY 2020: Industrial Strategies to Enhance Diversification and Competitiveness in the Kingdom of Saudi Arabia" prepared by the organization in 2006. Another example is the UNIDO 2011 report on Strategic Directions on Industrial Policy for Mongolia. The report assesses the performance of Mongolia's most important sectors, the characteristics of the manufacturing sector in the country, its contribution to the overall economy, the prevailing macroeconomic and institutional circumstances, and its performance relative to other countries at the same stage of development. After the initial assessment, UNIDO helped the Mongolian Government to define an industrial development and diversification strategy and made recommendations on industrial policy to help the Government achieve its development goals.

With the 1990s' internal and external convulsions also came another major change in the industrial policy thinking at UNIDO. At the institutional level, the United Nations system was beginning to recognize that to increase the impact of its development interventions, a much greater emphasis had to be placed on sustainability, both in terms of the environment and social inclusion. This new approach, coining the term "sustainable development" was heralded under the stewardship of Gro Harlem Brundtland, then United Nations Secretary-General, most notably through the Brundtland Commission, which reported in 1987. Its overarching recommendations would reverberate within the entire multilateral system, not least with UNIDO. These included:

- That sustainable development to be achieved globally meant "ensuring that the development meets the needs of the present without compromising the ability of future generations to meet their own needs".
- That population growth should take place in harmony with the changing productive potential of the ecosystem.
- That the poor should be guaranteed a significant share of global resources, and new economic growth patterns should be harnessed to assuage poverty.
- That international agencies should ensure that their operational activities encouraged sustainable development (Margariños, 2005, pp.59-60).

The growing importance of the environmental sustainability agenda meant that UNIDO's industrial policy thinking began including issues such as emissions, resource

and energy efficiency as well as pollution and waste in its industrial policy thinking. While specific green industrial policies are only now being developed (see section 10.6), environmental issues have been lingering in the discourse for some time and the emerging trade-offs between economic, social and environmental objectives of industrial policy much better understood.

10.3. Industrial policy in support of small and medium enterprises (SMEs)

Government support for small and medium enterprises in developing countries has been a constant dimension of UNIDO's policy thinking across its history. In early day the rationale was that SMEs were at a disadvantage to large and foreign firms and need to be nurtured and protected while in more recent times support to SMEs was also seen as a form of private sector development.

SME research has always emphasized the high degree of hetereogeneity in developing countries between large and small firms, with the former, which normally include multinational companies, perceived as modern and efficient while the latter are seen as backward and inefficient. A path breaking study about the size of companies in Mexico, particularly focused on micro, small and medium enterprises prepared by UNIDO in the early 1980's in Mexico presented a different scenario. Small and medium enterprises were found to be important breeding grounds for new technologies and advanced sectors; moreover, efficiency did not seem to be necessarily connected to the size of company in the case of Mexico. The study demonstrated that industrial development did not necessarily have to be connected to large enterprises and opened the door for new approaches and policies to support small and medium companies in the country (Mattar and Jacobs, 1986).

Research arising from UNIDO's Programme for the Comprehensive Development of Small and Medium Enterprises (PRODIMP) in Mexico led to further understanding of the plight and behavior of SMEs. Two findings were particularly influential in UNIDO's thinking and practice, particularly in the Latin American region. The first one related to the concept of micro industry. By applying criteria such as the number of persons employed and annual sales it was possible to establish behavioural differences between micro, small and medium industries and that micro enterprises possessed specific characteristics and peculiarities not shared by the other two segments. The second one referred to the approach to promote micro, small and medium enterprises. The conclusion was that successfully SME policy-making required a comprehensive

and coordinated approach of a variety of instruments ranked according to, *inter alia*, the nature of productive activities, priority regions and potential for job creation. These instruments included: preferential loans, tax incentives, technological support, supply of inputs and services, outsourcing, and business development (Peres, 1997).

As a result of the renewed focus on smaller companies, in the late 1980's, Mexico approved the Federal Law on Promotion of Micro Industry designed to establish a simplified procedure for the establishment and operation of micro-industrial enterprises (no more than 15 workers) and encourage their incorporation into the formal economy and its development regime through fiscal support, financial, market and technical and administrative assistance. Unfortunately, the extensive process of implementation of the program virtually concluded in December 1988 with the election of a new government in Mexico.

This type of programme, which later became very popular, was quite innovative at the time and set important ideas of how to promote and protect micro, small and medium enterprises in Latin America. It stressed the need to work with local people at particular sectors and regions, bringing international sectoral experts to work on site with small and medium entrepreneurs and their associations to solve specific problems identified by the entrepreneurs themselves.

One of its most prominent publications related to SMEs arising from UNIDO was the Manual for Small Industrial Business: Project Design and Appraisal from 1994 intended to be a set of ideas, concepts and recommendations for the promotion of small industrial businesses. An enterprise is defined as small if the entrepreneur is involved in the production process as well as in administrative and commercial tasks, which are frequently also carried out by family members. The Manual characterized small industrial businesses by a set of particularities such as their decentralized manufacturing operations and their reliance on local markets, their ability to cater to highly differentiated and individual demand by offering custom-made products, and the central role played by the entrepreneur, bearing the business risk (capital risk) and coordinating the business. The book provided guidance on the planning, analysis, appraisal and implementation of investment projects directed specifically to small industrial enterprises. The Manual aimed at shifting much of the data assessment work from the enterprise level to the sub-sectoral level, where profiles of successful small businesses could be created and used afterwards as a reference when assessing individual projects.

The Manual contained a detailed description of pre-investment studies of small industrial business sector, delineating pre-investment requirements and activities in

the sector. It also covered the identification and analysis of small-scale investment opportunities, with special attention to project preparation and appraisal at the enterprise and sub-sectoral level. The opportunity studies described in the Manual served for the creation of profiles of successful small industrial businesses, exploring their strengths and weaknesses as well as the prerequisites for, and constraints to, the establishment and operation of viable enterprises. Worksheets, schedules and questionnaires were included in the book to systematize and facilitate the assessment and processing of data.

UNIDO's analytical work and its many years of global involvement in promoting industrial SMES led to the development of a wide range of services to address specific weakness in the operating environment of SMEs and formulate and implement packages of measures to promote SME development. Among these are programmes to identify suitable network partners and forge long-term cooperative relationships within SME clusters; to broker arrangements to find suitable partners for SMEs that have access to international markets or connect them directly with foreign firms to increase international competitiveness; to support rural enterprises to increase non-farm income and employment opportunities for the rural population; and to support women entrepreneurship.

Figure 10.1: UNIDO Matrix of support programmes for SMEs

Target group	Primary development objective	Key challenge	Main Market Orientation	UNIDO Support Programmes	
Medium	"Fair" globalization	Competitive insertion into national and global value chains	Regional and Global export markets	Promotion of corporate social responsibility & Business Partnerships SME Export Consortia	SME Enabling Framework & Institutional Support Information Services
Small	Sustainable local development	Creating the "missing middle	National market and first attempts in exports markets	Cluster and Network Development	
Micro	Poverty Reduction	Moving from survivalist into growth mode	Local markets	Rural and women entrepreneurship & Human Security	

Source: Luetkenhorst, 2005, p.14

10.4. The revival of industrial policy and learning the lessons for industrial strategy

In a paper written for UNIDO in 2004 (and subsequently published in the CEPR Working Papers Series), Dani Rodrik developed a view of modern industrial policy which closely reflected emerging developments in business and innovation strategy. Rodrik began his contribution by observing the simultaneous failure of both state and corporate planning:

"Once upon a time, economists believed the developing world was full of market failures, and the only way in which poor countries could escape from their poverty traps was through forceful government interventions. Then there came a time when economists started to believe government failure was by far the bigger evil, and that the best thing that government could do was to give up any pretense of steering the economy. Reality has not been kind to either set of expectations. Import substitution, planning, and state ownership did produce some successes, but where they got entrenched and ossified over time, they led to colossal failures and crises. Economic liberalization and opening up benefited export activities, financial interests, and skilled workers, but more often than not, they resulted in economy-wide growth rates (in labor and total factor productivity) that fell far short of those experienced under the bad old policies of the past." (Rodrik, 2004, p.1)

This being the case, Rodrik argued, it was incumbent for both sets of stakeholders to recognize their weaknesses. They are required to work together. Thus:

"The right model for industrial policy is not that of an autonomous government… but of strategic collaboration between the private sector and the government with the aim of uncovering where the most significant obstacles to restructuring lie and what type of interventions are most likely to remove them. Correspondingly, the analysis of industrial policy needs to focus not on the policy outcomes—which are inherently unknowable ex ante—but on getting the policy process right." (Rodrik, 2004, p.3)

In contemporary parlance this is referred to as "stakeholder alignment". This necessarily entails a process of emergent strategy, involving the range of stakeholders along the value chain (from basic knowledge development to users and waste dispersal) working together in the strategic equivalent of "open innovation".

This early contribution by Rodrik in his UNIDO paper has been extremely influential in setting the terms of debate on contemporary industrial policy. (In its published form, the paper has more than 1,700 citations in Google Scholar). Its central story—that strategies include stakeholder collaboration and are emergent in nature, involving processes rather than paper—stands in stark contrast to the Industrial planning documents of the Soviet Gosplan era and the five-year plans which guided industrial policy in India and many other developing economies in the 1960s, 1970s and 1980s.

Rodrik's paper is an example of UNIDO spearheading the debate on the renewed role of industrial policy. In opposition to the 1960s and 1970s interventionist government policies to promote development, the rise of market fundamentalist in the 1980s brought a rejection of any proactive government attempt to foster structural transformation. The success of countries with an active industrial policy in East Asia; the failures in the rest of the world that followed the dominant Washington Consensus policy framework; and, finally, the financial crisis in 2008-2009 forced the rethinking of macroeconomic strategies and industrial policies. (Stiglitz et al., 2013)

UNIDO papers at that time advocated that structural change in a global economy required complex strategic choices, and markets, if unaided, could neither solve existing issues, nor coordinate interrelated investments. Therefore, the main objective of industrial policy should be to anticipate structural change, facilitating it by removing obstacles and correcting for market failures (Syrquin, 2007). Anticipating where to diversify and what to upgrade required, however, concerted private-public action through government policies going hand in hand with private initiatives. Successful industrial development could not be based on the decisions of individual entrepreneurs alone; it required government and the private sector to work alongside and develop a broad consensus about development objectives.

In this context, a new way of conceiving and conducting industrial policy emerged in the literature, moving away from the "dichotomic" view of the role of the state to a process-oriented, multi-stakeholder-driven, flexible and open-ended approach. The modern thinking on industrial policy is characterized by its process orientation and by placing the interaction between actors at the centre of this process. The focus is on how the interface between public and private actors takes place, under what conditions and in which roles. Modern industrial policy approaches require the establishment of an environment of mutual learning, dialogue and understanding, as well as the enhancement of key actors' capacities (Gunther and Alcorta, 2011).

New industrial policy is viewed as a "discovery process" where entrepreneurs, governments and other relevant stakeholders get together to learn from each other about costs and opportunities and to engage in strategic coordination to select best options for industrial diversification (Rodrik, 2007). Close and sustained consultation on existing views takes place among private and public sectors in order to make strategic decisions. Stakeholder ownership and steering are crucial in decision making, as it facilitates the implementation process and increases the chances of success. UNIDO's Strategic Management of Industrial Development (1991) already anticipated this approach in the early 1990s by defining industrial policy in terms of "public and private sectors jointly identifying and lifting the constraints that impede the transformation of industry (Gunther and Alcorta, 2011).

UNIDO has produced a taxonomy of industrial policies, arguing that industrial policy does not represent a "silver bullet" solution for economic growth, but must be approached through a process of learning.

"Whilst economic theory and historical experience provide a justification for IP interventions, successful application of such a policy is far from inevitable and there are many examples of policy failures as well as successes. Current thinking stresses that there is no unique set of interventions and that success is often linked with the manner and institutional context in which they are implemented. Thus, there is a need for an experimental approach which adjusts policy and changes its instruments and emphasis in the light of learning through application." (Weiss, 2016)

The study categorizes suitable types of policy interventions according to a classification of "early", "middle" and "late" stage industrial policies. At the early stage, the following objectives are recommended:

- Diversification of exports away from primary goods into simple manufactures
- Processing (or "beneficiation") of natural resources into resource-based manufactures
- Attraction of FDI to generate technology, management or marketing links
- Encouraging new start-up firms

These may be accompanied by policy interventions including (Weiss, 2016):

- Provision of credits or loan guarantees
- Incentives for FDI or technology
- Vocational skills training
- Incentives (taxes, import tariffs, subsidies) to raise the relative profitability of either all or targeted parts of manufacturing

- Use of special zones or estates to draw on any agglomeration economies (particularly where it is difficult to provide good quality infrastructure on a country-wide basis)
- Similarly, at the middle stage, the following key objectives have been identified by the study:
    i. Promotion of higher value-added medium and high technology products
    ii. Development of local adaptations to foreign technology
    iii. Upgrading of local firms within global value chains
    iv. Establishment of international marketing links to develop own brand products
    v. Integration of environmental policy as an aspect of IP

UNIDO thus recommends the following instruments for middle-stage countries (Weiss, 2016):

- Innovation or venture capital to encourage investments in new activities or technologies
- Incentives for more technologically advanced FDI
- Subsidies to local R&D and the encouragement of research consortia and industry-university links
- A focus on higher-level skills training and higher education
- Use of public procurement contracts or supplier development programmes to encourage local suppliers

Finally, the late stage represents economies with sophisticated scientific and technological infrastructure, for which a degree of protectionism for sunset activities is anticipated, given the presumed lack of competitiveness on the basis of existing technologies (Weiss, 2016). For such cases, it is recommended to implement the following measures:

- Public-private R&D activity and support for research consortia (possibly combined with public procurement policy)
- Venture capital for high technology investments
- Higher education investment in applied science-based subjects
- General educational improvements
- Funding for enterprise restructuring
- Retraining workers

Table 10.2 Industrial policy taxonomy

Market-based measures	Coverage	Rationale
R&D tax credits	Functional	Technology spillovers and risk-taking externalities
State Industrial Research and education	Functional	Creation of national technology capability
Labour training subsidy	Functional	Labour training externality
State venture capital funds	Selective	Risk-taking externality
State export promotion agency	Functional	Lack of information and provision of public good
Infrastructure provision for special economic zones	Functional	Encouragement of clustering and agglomeration effects
Profits tax holidays	Functional	Encouragement of manufacturing investment
Undervaluation of exchange rate	Functional	Encouragement of internationally traded activities, including manufacturing
Promotional measures		
Temporary financial assistance	Selective	Funding to allow restructuring of uncompetitive activities
Temporary import tariff protection	Selective	Protection of uncompetitive activities requiring restructuring
State procurement policy	Selective	Priority in access to public sector contracts
Export subsidy	Selective	Differential rates of subsidy based on productivity potential
Import tariffs	Selective	Differential rates of protection based on productivity potential
Directed credit	Selective	Priority allocation of credit based on productivity potential
Profits tax holidays (selective)	Selective	Favorable tax treatment for foreign investors
Incentive packages of tax, loans and infrastructure	Selective	Favorable treatment for foreign investors

Source: Szirmai et al., 2013, p.398

Similarly, the importance of manufacturing industries per se became sidetracked in the development discourse during the 1990s when social sectors came to dominate the agenda. UNIDO kept throughout this time advocating for the importance of manufacturing as an engine of economic growth. This discourse is now vindicated

by the renewed emphasis on manufacturing as a driver of technological innovation and productivity enhancement, and the fear that many developing countries might suffer from "premature de-industrialization" (Rodrik, 2015).

10.5. Emerging challenges in industrial policy

Ideological opposition to industrial policy has been weakening in recent times as many developing and developed countries adopt new industrial policies or industrial development frameworks. Evidence suggests that within the 50 years since the establishment of UNIDO, the best economic performance was obtained by those countries that defied the "conventional wisdom" and used heterodox policy strategies, including industrial policies, in opposition to countries that followed strictly the "standard consensus".

Successful industrialization has rarely been the result of free market forces, a variety of experiences attest to a proactive role of industrial policy in this regard. Industrial policies have played a central role in inducing industrial transformation, diversification and upgrading towards more resilient and competitive, as well as environmentally friendly and socially inclusive, industries. UNIDO's research work analyzing and comparing different countries' experiences has demonstrated that there is no one-size-fits-all approach when it comes to industrial policies. In order to avoid past mistakes that have led into the severe criticism, policies need to take into consideration contextual factors and the conjuncture. Recently, the industrial policy issues that have been dominant in UNIDO's early agenda have given way to new challenges.

The emergence of global value chains has changed the nature of international competition. It has become increasingly more difficult to achieve industrialization or endure successfully in an unequal and globalized economy, as poor countries try to catchup through industrialization and advanced economies struggle to maintain their competitiveness. One of the main challenges countries face nowadays is strategically integrating into global value chains and upgrading position in those value chains over time. Integration and upgrading require a great emphasis on innovation, transport and agglomeration effects rather than on old industrial policy instruments such as tariffs, exchange rate and quotas (Szirmai et al., 2013).

This challenge is increased by the shrinking policy space for latecomers to industrialization. The loss of policy space results from the prominence of multinational

companies in GVCs, which have a crucial role in controlling access to new technologies. Moreover, the governance mechanisms in place restrict the policy options available especially for developing countries, as they have to abide by rules set in the World Trade Organization, multilateral and bilateral agreements. Finally, those countries also have to face the competition of China and India when entering the market for manufactured products and exports.

The slow rate of job creation in manufacturing in economies with relatively low wage levels has also been a reason for concern. The growth of employment in manufacturing has been slowing down under the influence of increasing capital-intensity and labour-saving technological change. The challenge of jobless growth is relevant in many countries. The relocation of resources within and between sector, and the relationship between the industrial sector, service sector and agricultural sector need to be reconsidered so that the potential of manufacturing industry to create high-productivity jobs is increased. At the same time, it is necessary to create adequate systems of financial intermediation that ensure that the long-term funds needed for industrial investment are forthcoming (Szirmai et al., 2013).

Globally, there are emerging fears of economic development becoming increasingly unequal in terms of the distribution of incomes and wealth, and exceedingly unsustainable in terms of its demands on the ecosystem and planetary boundaries. Therefore, industrial policies also need to respond to current global threats such as climate change. Achieving low-carbon industrialization requires selective government intervention to foster waste reduction and alternative "green" pathways. This will require global policy cooperation, innovation and transfer of environmentally more sustainable technologies.

With its current emphasis on inclusive and sustainable industrial development, UNIDO is at the forefront of the debate about the new challenges and paradigms on industrial policy. If in the past, industrial policy was state-oriented and top-down based, the new industrial policies need to be more interactive and experimental, maintaining a strong relationship between governments and private sector.

CHAPTER 11

LOOKING INTO THE FUTURE: BY WAY OF CONCLUSIONS

The review of global industrial development in the five decades since UNIDO's establishment (Chapter 2) tells a story of remarkable change. Within mere 50 years—a relatively short period in industrial history—there was a major shift in industrial activity worldwide, whose significance for the industrialized world was akin to the impact of the rise of North America on Europe in the 19th century. Not only did the centre of gravity in many manufacturing sectors move from the north to the south, but the character of manufacturing production also shifted in remarkable ways, with high degrees of interconnectedness in production systems and the emergence of mass markets in both the north and the south.

Little of this change could have been predicted in 1967. Hence, it would be foolhardy to attempt to map out an agenda of industrial change in the coming fifty years, the more so since the pace of change has speeded up since UNIDO was formed five decades ago. Nevertheless, there are indications of emerging and potential factors which are likely to have significant impacts on future industrial growth. These can be grouped into three categories – binding constraints, known uncertainties, and "quasi-black swans". Each of these developments pose threats to, and offer opportunities for development and industrial progress – the balance between threat and opportunity will reflect the way that humankind responds to these challenges. From UNIDO's perspective, the challenge is augment to the fullest extent possible the potential for positive outcomes, particular those which accord with the global commitment to the Sustainable Development Goals.

11.1. The binding constraint

There is a single binding constraint which will affect, and in many respects determine, the trajectory of local, regional and global industrial growth in the coming decades,

including in the relatively near term. This is the spectre of climate change and climate chaos, where (as was shown in Chapter 9), the accumulated effluents of industrial expansion have already led to irreversible changes in the environment and threaten to unleash even more significant changes in the future.

The threats this poses to industrial production, and particularly the global dispersion of industrial production are obvious and manifold. Industry is simultaneously a consumer of the environment (drawing natural resources into the production process) and a displacer of effluents into the environment. Both of these ends of the production spectrum will be affected by climate change. On the input side of the equation, many materials will see a rise in price, a change in quality (often a degradation in quality as in the case of water), a change in geographical source and a heightened degree of uncertainty as climate variability increases. On the output side, the growth in the regulation of industrial activities and demand pressure for more environmentally responsible production will constrain the historical capacity of industry to displace effluents carelessly.

UNIDO's current "concepts in use" of resource and energy efficiency, renewable energy, clean production and green industry will need to evolve to connect with the systemic and interrelated nature of industrial production and consumption and focus not only on how to examine industry statically or specific aspects of industrial processes and behavior but also to understand how to close loops to turn outputs from one manufacturer into inputs for another. The notion of the "circular economy", for example, addresses simultaneously the need to promote greater resource efficiency and to design products and processes for recycling and reusing with that of extending the life of products through reconditioning activities and reducing waste and pollution. The circular economy may be a significant aspect of UNIDO's intellectual discourse and contributions to the wider body of knowledge in the years to come.

Indeed, thinking along circular economy lines may provide opportunities for further ideas and new UNIDO technical cooperation activities. New capital goods will be required, new environmental services will be in demand and new modes of consumption (including, for example, the sharing of consumer durables such as automobiles) provide major opportunities for the expansion off value added services. The advantage of the circular economy concept is that it doesn't put the environment but production and consumption at the core of the environmental discussion, something that can only benefit the intellectual and applied activities of the organization. Some economies, notably Germany, Denmark and China, have already begun to specialize in these green industrial areas and to see this as an opportunity for industrial expansion.

11.2. Known uncertainties

Already on the horizon are a series of developments which are likely to affect the nature of local, regional and global industrial production. These are similar to the challenges faced over the last twenty years (Chapter 2) but with a much more transformational power or deeper impact. Unlike the binding constraint of environmental change, existing patterns of industrial activity could continue largely unhindered without any response to these emerging developments – the "known uncertainties". However, with appropriate responses, each of these developments holds out the potential to strengthen the sustainable and equitable industrial expansion set out in SDG9 that is, to "build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation".

11.2.1. Industrial structural change and economic growth.

Sustaining economic growth

Global economic growth has decelerated since the financial crisis, from around 3 percent during 1991-2008 to approximately 2.3 percent during 2009-2015. Growth deceleration is taking place across the globe and although some countries have been still experiencing rapid growth most countries, particularly among developed ones, are not back to the levels of growth of the past. Many developing countries that were benefiting from the commodity boom of the past decade are also seeing growth in their economies slowdown while exporters of manufactured products are facing falling world trade. For the world to prosper and full employment to be achieved, rates of growth need to be much faster of what they currently are.

Throughout its history UNIDO has argued that manufacturing is one of the main drivers of economic growth through inter-sectoral and intra-sectoral processes of structural change (Chapter 4). Yet structural change is not straightforward to achieve, changes through time and varies across population sizes, resource endowments and countries (Chapter 4). Developed countries are moving not only into high-tech industries but also into-high tech services fundamentally changing the nature of structural change processes as experienced in the past and the world is entering a new industrial revolution with unclear impact over production processes, productivity and location of production worldwide. Many more consumers are entering the market from lower income countries, reflecting patterns of consumption that may differ markedly from "traditional" patterns.

These emerging trends will challenge the structural change approach of UNIDO as

the past may not be the only predictor of the future. UNIDO's thinking will have to be able to predict what trends will affect upcoming industrialization, what and how the new processes of structural transformation may look like and what are the policy responses required to address those changes. This will require accessing data hitherto not available at UNIDO and a more in-depth analysis not only of patterns of structural change but above all, of their determinants, something that will require a much more advanced statistical and analytical capability than what is available today.

Natural resources and industrial growth

As observed in Chapter 2, UNIDO's establishment occurred in the context of a growing recognition that the terms of trade (that is the relative prices) of commodities were turning adversely against the price of manufactures. At the same time, the low level of capabilities in many resource-intensive developing economies meant that there were only limited linkages between the resource sector and the industrial sector. The recognition of these developments was a key contribution made by the first head of UNIDO's Industrial Development Center research division, Hans Singer, and this was one of the prime motivators for a programme of concerted industrial development in developing economies.

These arguments for manufacturing to turn its back on the resource sector are challenged by four relatively recent sets of developments. First, there is a close link between the resource-intensity of final demand and per capita incomes. Many natural resources are utilized in the infrastructure sector. As low and middle income countries expand their economies, their investments in infrastructure are relatively intense, and their demand for commodities increases. Similarly, as per capita incomes grow beyond basic survival, there is generally a relatively high demand for food products, as well as for land-intensive animal proteins. For these reasons, as per capita incomes in low income economies grow, so will the derived demand grow for natural resources. Secondly, at the same time, many natural resources have exhausted low cost deposits, so that new supplies are increasingly costly to produce. The combination of these two factors led to an unprecedentedly prolonged rise in the relative prices of natural resources between 2002 and 2013, arrested only by the prolonged economic crisis which followed the financial crisis of 2008. Third, there has been an increasing differentiation in the nature of final products in the resource sector – an array of different forms of coffee, wheat and other products has been introduced and demand has emerged for new commodities such as rare earths. These patterns of product differentiation provide much scope for the value added processing of commodities. And, fourth, capabilities in many developing economies have grown markedly since

1967 when UNIDO was established, so that the capability-gap limiting linkages between the resource and the industrial sector has shrunk.

These developments do not remove the rationale for industrial development. But what they do is to soften the either-or approach to manufacturing-commodities which has characterized much of industrial strategy over the past five decades. New opportunities for a resource-augmenting path of industrial development are emerging. Particularly when linked to the soft commodities sector (agriculture), they offer the potential to enhance the degree of social and economic inclusion in industrial development.

What constitutes "manufacturing?"

One of the paradoxes of post-war industrial development (considered in Chapter 4 on structural change) has been a change in the historic relationship between per capita income growth and the share of manufacturing in value added. As was shown in Chapter 2, the documentation of these trends is partly a function of the manner in which the calculations are made, with the share of MVA in GDP being measured on the basis of inter-country averages, irrespective of the size of different economies. But a second important explanatory factor is the changing structure of global manufacturing.

During the 1960s when the link between industry and per capita incomes received most empirical attention, industrial production and consumption largely occurred within countries. Where there was trade in manufactures between economies and regions, this was largely in finished products, involving high degrees of domestic value addition. But, as was shown in Chapter 8, the advance of Global Value Chains occurred through the increasing fragmentation of production. Many activities which were had historically been undertaken within manufacturing firms - such as design, marketing and logistics - were hived off to specialized subcontractors. At the same time, within manufacturing, relatively low skilled and low value added activities were outsourced to developing economies with low wages.

The consequence is that manufacturing no longer lends itself to a standalone policy agenda. Manufacturing processes of assembly and the transforming physical inputs into physical outputs (which with the outsourcing of knowledge intensive services comprise an increasing proportion of manufacturing) cannot occur without the complementary knowledge-intensive activities which now occur within the service sector. Table 4.1 shows the composition of what could be termed the "new manufacturing".

Hence, it is increasingly the case that policies designed to augment industrial value

added and the share of industry in GDP must necessarily include a range of related business-services. Similar developments occur with respect to the relationship between the agricultural and minerals and metals sectors and the related services sector. Hence, the terrain of industrial policies, particularly industrial policies designed to provide for sustainable income growth, will need to widen to incorporate also a series of related business services sectors.

Table 11.1: Composition of the "new manufacturing"

		Sectors
Group	**World Input-Output Database**	**International Standard Industrial Classification Revision 3**
Business Services	29, 30	K
Financial Intermediation	28	J
Manufacturing	3-16	D
Other Services	31-35	L-P
Transport	23-27	I
Wholesale	19-22	G-H
Aggregate Service Employment	19-35	G-P

Source: UNIDO, 2013, p.42.

11.2.2. Inclusiveness

The demographic dividend

In many countries, there is a substantial overhang of unemployed and underemployed labour. In some regions, particularly Africa, this surplus labour force is increasingly made up of young people, some of which have moved to more advanced economies. In other regions of the world, particularly in the high income economies, the demographic profile shows an expansion in the proportion of older people in the population. Left unanswered, this challenge poses enormous political and social

threats, not just within national borders, but in some cases spilling over into regional and global polities. On the other hand, history shows that labour is a critical input into production and a source of production, knowledge and innovation.

Growing inequality

As we saw in Chapter 2 growing inequality has been one of the key characteristics of the last 25 years. Unlike perhaps UNIDO's early years when inequality took place across countries, in recent years global inequalities seems to be accounted for differences in inequalities within countries, both within middle income countries but unexpectedly, also within OECD countries. While manufacturing is not the only cause behind inequality increases it has been both part of the problem and the solution. On the positive side growing manufacturing employment in developing countries is at the root of decreases in inter-country inequality as rapidly industrializing countries in Asia narrow the income gap with developed countries. On the negative side, the large losses of manufacturing employment since the 2008 financial crisis in developed countries leading to many manufacturer workers losing their income and at best only partially compensating it with lower paid jobs in other sectors is also at the basis of growing OECD inequity.

The intellectual challenge for UNIDO will be thus to identify ways to transform this threat of the disaffected and marginalized unemployed into an opportunity for augmenting growth and human welfare. Industry and innovation clearly have important roles to play in meeting this agenda in developing countries, from the promotion of SMEs to the acceleration of structural change, to the development of labour-intensive production, and to the development of industrial technologies which draw on the creativity and the skills of human potential. Speeding up the rate of innovation so that new high-tech industries, and their related services, which are proving a major source of new employment generation, will be critical to expanding manufacturing employment in developed countries. Particularly in the case of a growing global population of older people in developed countries, many of whom will have specific health needs, industry also offers the possibility of producing new products to meet their special needs.

Finding ways of improving wages and reducing informalization to reduce inequities will also require some thinking within UNIDO. While the connections between increasing wages, higher productivity and structural transformation have been well established there is less understanding on how can sustained processes of structural transformation can be triggered. An even more daunting challenge, particularly in the light of upcoming technological change, will be to find ways of promoting the

formalization of industrial workers, particularly in middle income developing countries, as a way to improving their incomes and working conditions. Much can be done by the organization also in terms of technical cooperation since many developing countries are struggling to come up with practical solutions and programmes to address this challenge.

11.2.3. Technology and innovation

The new industrial revolution

The pace of technological change is very rapid. Some visionaries forecast a world of major change, with artificial intelligence and robotization not only excluding much of the population from employment but autonomously taking major strategic decisions for humankind with Orwellian overtones. But not all technological change will be so dramatic and so threatening in nature. As Table 11.2 illustrates, there are already a series of technologies under development which have provide manifold opportunities for industrial production.

Table 11.2: The potential of radical innovations for developing countries

Technology	Definition	Economic Effect
Mobile Internet	Combination of mobile computing devices, high speed wireless connectivity and applications.	$3.7 trillion to $10.8 trillion per year by 2025. $1.85 trillion to $5.4 trillion per year in developing countries.
Knowledge Work Automation	The use of computers to perform tasks that rely on complex analyses, subtle judgments and creative problem solving.	$5.2 trillion to $6.7 trillion per year, by 2025. $1 trillion to $1.3 trillion per year in developing countries.
Internet of Things	The use of sensors, actuators and data communication technology built into physical objects- from roadways to pacemakers- that enable those objects to be tracked, coordinated or controlled across a data network or the Internet.	$2.7 trillion to $6.2 trillion per year by 2025. $0.81 trillion to $1.86 trillion per year in developing countries.
Cloud	It brings computer architecture full circle, enabling network access to a full pool of computer resources such as servers, storage, and applications that can be used as needed.	$1.7 to $6.2 trillion per year by 2025. $1.19 to $4.34 trillion per year in developing countries
Advanced Robotics	Advanced robotics have greater mobility dexterity, flexibility and adaptability, as well as the ability to learn from and interact with humans, greatly expanding their range of potential applications.	$1.7 trillion to $4.5 trillion per year by 2025. $0.3 trillion to $0.9 trillion per year in developing countries.
Autonomous and Near Autonomous Vehicles	An autonomous vehicle is one that can maneuver with reduced or no human interaction.	$0.2 trillion to $1.9 trillion per year by 2025. $0.04 trillion to $0.38 trillion per year in developing countries.
Next Generation Genomics	Next generation genomics can be described as a combination of next generation sequencing technologies, big data analytics and technologies with the ability to modify organisms which include recombinant techniques and DNA synthesis.	$0.7 trillion to $1.6 trillion per year by 2025. $0.14 trillion to $0.32 trillion per year in developing countries.
Energy Storage	Energy storage systems convert electricity into a form that can be stored and can be converted into electrical for later use, providing energy on demand.	$ 0.09 trillion to $ 0.63 trillion per year by 2025. $ 0.03 trillion to $ 0.25 trillion per year in developing countries.

Technology	Definition	Economic Effect
3-D Printing	3-D printing belongs to a class of techniques known as additive manufacturing. Additive processes built objects layer by layer rather than through molding or subtractive techniques.	$0.23 trillion to $0.55 trillion per year by 2025. $0.09 trillion to $ 0.2 trillion per year in developing countries.
Advanced Materials	Any use or manipulation of materials which features at a scale of less than 100 nanometers (roughly molecular scale) can qualify as nanotechnology.	$0.15 trillion to $0.50 trillion per year by 2025. $0.015 trillion to $0.05 trillion per year in developing countries.
Advanced Oil and Gas Exploration and Recovery	Unconventional oil and gas reserves are defined as reserves that cannot be extracted by conventional drilling methods.	$0.09 trillion to $0.46 trillion per year by 2025. $0.018 trillion to $0.092 trillion per year in developing countries.
Renewable Energy	Renewable energy is energy that is derived from a source that is continuously replenished, such as the sun, a river, wind, or thermal power of world oceans.	$0.16 trillion to $0.27 trillion per year by 2025. $0.12 trillion to $0.21 trillion per year in developing countries.

Source: UNIDO, 2016, p.55

Many of the technological developments making the "new industrial revolution" outlined in Table 11.2 may appear to be exclusively suitable for high income consumers and producers in high income markets rather than for low income consumers and developing country environments. Yet experience has shown, counter-intuitively, that the primary beneficiaries of radical technological change are often in developing countries, and are often poor people. The application of mobile telephones for electronic money transfer has not only augmented consumer welfare, and small scale and dispersed industrial and agricultural production in Africa, but also disrupted the operations of the inherited financial system.

Yet, as in all cases, the potential offered by technological change has both a bright side and a dark side. The Austrian economist Joseph Schumpeter illustrated the capacity of significant innovations to sweep away established production systems. He referred to this as "gales of creative destruction". However, misused new technologies also have the potential to become "gales of destructive creation", not only when used to manufacture weapons of mass destruction, but also in unleashing unstoppable chain reactions with severe environmental and health impacts.

Again the task for UNIDO's thinking is how to ensure that the "gales of creative destruction" are spread globally and benefit everyone. The new industrial revolution

is at its very beginning and it is not clear how deep impact on production systems will individual technologies have and even less so how will they work together. Trying to understand the mechanics of upcoming technological change will in itself be a great contribution to the organization and beyond. Insofar as the new industrial revolution is spearheaded by developed countries another area for knowledge development will be how to disseminate the information and spread the emerging technologies across the globe. Technology transfer will take a completely new meaning in the era of Internet and equipment that can communicate and react simultaneously to instructions being issued automatically at the other side of the world. The fact that the world is facing technological change that is spreading global will require responses at the same level, which also opens opportunities for UNIDO to research and develop services attuned not only for developing countries but for the world as a whole.

If the nature of upcoming technological change is unclear, even less clear will be the effects that radical technical change will have on society. This is fertile territory for addressing the traditional UNIDO questions of how will middle income and low income countries fare in the light of the new industrial revolution. But it also open the field for venturing into questions related to the nature of R&D that different countries will have to get involved in, what new skill set will be require to be able to absorb the new technologies, what will be the emerging infrastructure and financial requirements and what environmental and technical standards will be necessary to address new developments. UNIDO is already positioning itself at the center of these issues through organizing the Global Manufacturing and Industrialization Summit (GMIS) but it will also have to contribute intellectually if it wants to be credible among key stakeholders.

Off-grid and decentralized production

Post-war industrial and economic growth occurred on the back of increasing scale economies in production. Global factories, and in some cases, whole towns and cities, specialized narrowly in the production of particular activities and products destined for distant and global markets. These scale economies in production both followed from, and reinforced the provision of grid-intensive infrastructure, such as energy, communications and water. The trends to the concentration of production were not only reflected internationally, but also within economies, contributing in developing economies especially to the marginalization and exclusion of rural and small-scale communities.

A combination of developments suggests that these adverse locational trends of concentration might be subject to change. Increasingly, many formerly grid-based public goods such as energy, telephony and clean water are economically available in the form of off-the-grid, independent, standalone and small scale utilities. Solar power and other energy renewables, small scale water treatment plants and mobile networks all undermine the centralizing drivers of industrial and agricultural production. At the same time, technological developments such as 3D printing provide the opportunity for efficient production at smaller scales of customized production.

Industrialization through globalization led to the ever-growing separation of production from consumption, working from living. The combination of off-grid infrastructure and new descaling technologies offers the potential to reverse these historic tendencies. Industrial production and the consumption of industrial output might be brought closer together; work and living may similarly be integrated, reducing the global exodus of rural-urban and cross national migration. Rural communities, distant communities and smaller agglomerations of people may be offered new opportunities of involvement in industrial production and in enjoying the fruits of economic growth.

11.3. Quasi-black swan events

"Black swan" events are the events that have a significant impact, are surprising and unexpected and are, with historical hindsight, generally rationalized as having been in the realm of the expected, but without the risk-aversion steps being taken which are necessary to mitigate their impact. By their nature, therefore, such events are impossible to predict. In pure form, since Black Swan events are inherently unpredictable, there is not much that can be said about their potential impact on industry but to note the potential for their development. A massive volcano or meteorite striking the earth which disrupts the global atmosphere, limiting international transport and industrial production are examples of these Black Swan events.

But between these wholly unanticipated events and events which are clearly predictable (and which are the subject of existing knowledge and policy responses), lie a series of potential developments which have a major impact, but whose emergence and form are nevertheless difficult to predict. These can be termed "Quasi Black Swan Events". At this time, at least one such event looms on the horizon – a major financial crisis.

The financial crisis in 2008 had a major impact on global industrial activity, predominantly in the high income economies. As it has been widely documented, this reflected a series of events driven by excess liquidity in the global economy, and the primacy of financial speculation at the expense of investments in productive capacity. The steps taken in response to the 2008 crisis have not resolved the problem, and there remains a large, and an increasingly large, financial overhang in the global economy.

How this excess liquidity will work itself out is unclear. It is possible that the fallout if and when another financial crisis occurs will leave an industrial sector with an unchanged trajectory, with the only casualties being felt in the financial sector. But this is unlikely, and almost certainly there will be significant impacts on the rate, character and location of local, regional and global industry.

From UNIDO's perspective, the task is to build the capacity to anticipate and the facility to respond flexibly to radically changing circumstances into the planning and policy system. As in the case of the binding environmental constraint and the Known Uncertainties discussed above, the outcome of a potential major crisis need not only be negative for developing economies in general and for the excluded in particular. One possible scenario of a future financial crisis is that a major shakeout will clear the dust surrounding environmentally destructive, large scale and excluding industrial systems and usher in a new epoch of distributed green production systems.

Many of the building blocks of this new industrial era are already in existence; others (for example the technologies described in Table 11.2) are on the horizon. But as in all social developments, threat will only be turned into opportunity with appropriate social responses. And, in its own limited way, UNIDO—in all of its activities, including through its own discussions and its sustained contribution to the Intellectual Agenda—will have an important mitigating role to play.

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Acronyms

CBA	Cost benefit analysis
CIP	Competitive industrial performance
CP	Cleaner production
ECOSOC	UN Economic and Social Council
EnMS	Energy management systems
EOI	Export-oriented industrialisation
EPZs	Export processing zones
EU	European Union
FDI	Foreign direct investment
FE	Foreign entrepreneurs
GDP	Gross domestic product
GVC	Global value chain
ICT	Information and communications technology
IDB	Industrial Development Board
IDR	Industrial Development Report
ILO	International Labour Organization
IP	Industrial Policy
IPAs	Investment promotion agencies
ISI	Import-substituting industrialization
ISIC	International Standard Industrial Classification
ISID	Inclusive and sustainable industrial development
ISO	International Organization for Standardization
LDCs	Least developed countries
MDGs	Millennium Development Goals
MIDA	Malaysian Industrial Development Authority
MVA	Manufacturing value added
NCPCs	National Cleaner Production Centres
NEP	New economic policy
NIEO	New international economic order
NSOs	National statistical offices
OECD	Organisation for Economic Co-operation and Development
PCP	Programme for country partnerships
R&D	Research and development
RECP	Resource-efficient and cleaner production
SDGs	Sustainable Development Goals
SEZ	Special economic zones
SMEs	Small- and medium-sized enterprises
SOE	State-owned entefrprise
STI	Science, technology and innovation
TEST	Transfer of environmentally sound technologies
TFP	Total factor productivity
TNCs	Transnational corporations
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
UNSO	UN Statistical Office
WTO	World Trade Organization

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