UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

Transfer of Technology for Successful Integration into the Global Economy

A Case Study of the Salmon Industry in Chile



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Preface

UNCTAD's series *Transfer of Technology for Successful Integration into the Global Economy* consists of case studies on transfer of technology issues in individual industries in selected developing countries. These studies draw lessons from national experiences with the transfer and diffusion of technology through various channels.

The studies highlight the crucial role that successful transfer of technology can play in the integration of countries into the global economy. They focus on the modes of technology transfer, and the adaptation, diffusion and further development of the acquired technology in the wider economy.

The studies also look at the interplay between technology transfer and development. They focus on the contribution of technology transfer to employment creation, export competitiveness and national innovative capacity. Thus, they provide lessons to other developing countries on building technological capacity and promoting development.

The studies deal with sectors where the selected developing countries have demonstrated their ability to create new productive capacities and successfully integrate into the world economy. They provide examples of cases in which a country's factor endowments were modified through investment in physical capital, human resources and the building up of capacities required to develop and use new technologies.

The present study is part of the second round of case studies in this series. The first round included a case study of Embraer in Brazil, a case study of the pharmaceutical industry in India and a case study of the automotive industry in South Africa. The second round will also include case studies on the automobile components industry in Tunisia and the electronics industry in Thailand.

The identification of firm-level factors as well as government policies and institutions that enable firms to thrive, grow and compete in the world market is vital to understanding the catch-up process and the building of technological capacity. These case studies seek to identify the conditions under which industries developed and some of the key institutions that played a role in this process.

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Abbreviations

| APSTC | Association of Producers of Salmon and Trout in Chile |
|---------|--|
| CORFO | Corporación de Fomento de la Producción |
| FDI | foreign direct investment |
| FIP | Fund for Fisheries Research |
| FONTEC | National Fund for Technological and Productive Development |
| IFOP | Fisheries Development Institute |
| Intesal | Instituto Tecnológico del Salmón |
| JICA | Japanese International Cooperation Agency |
| R&D | research and development |
| SERPLAC | Secretaría Regional de Planificación y Coordinación |
| TNC | transnational corporation |
| TOT | transfer of technology |
| UN | United Nations |
| UNCTAD | United Nations Conference on Trade and Development |

Executive summary

The emergence and the development of the Chilean salmon industry demonstrate the important role of technology transfer in industrial development. Technology transfer has enabled Chile to build a globally competitive and innovative salmon industry over the last two decades. The industry has become one of Chile's main export sectors and a significant contributor to regional development. Today, Chile is the second largest salmon producer in the world and develops technology for the production of other fish species.

The successful development of the industry highlights Chile's approach to industrial and economic development. Chile promotes scientific and technological innovation that adds value to or generates industries based on its natural resource endowment. In this case, the long coastline, abundant freshwater sources and islands, and good climatic conditions are part of its natural endowments, which, with the appropriate technologies, have played a vital role in the development of the salmon industry.

The development of the industry was a painstaking process and success was not assured. Chile undertook several trials, including attempts to stock rivers and lakes, spanning several decades in order to master fish-farming technologies. It solicited technical support from several international institutions with experience in fish breeding and farming and used its national institutions to acquire, assimilate, develop and diffuse fish farming technologies. Some of the early firms were created by public institutions and researchers that had accumulated some basic operational knowledge and skills in fish farming.

Several prominent national players that promote the development of firms and technologies facilitated the diffusion of salmon farming technologies. Among others, Fundación Chile, Corporación de Fomento de la Producción (CORFO) and Instituto Tecnológico del Salmón (Intesal) played very prominent roles in the development of the industry in Chile. Fundación Chile established Salmones Antártica as a limited company, which demonstrated the commercial viability of large-scale farming, breeding and production of salmon. In addition, the firm carried out research activities on farming procedures and provided technical assistance to small and emerging producers. The rapid growth of Salmones Antártica stimulated private interest and led to the expansion of the industry.

The close cooperation between government agencies and the salmon producers played a vital role in the growth of the industry, especially in the development of licensing regulations, sanitary standards and supporting research and development activities (R&D). Similarly, R&D institutions have worked closely with the national fishing agency, the National Commission for Science and Technology and the salmon industry.

The industry has also been successful in the assimilation of foreign technologies and development of indigenous technological capability. Some of the major accomplishments include the acquisition and development of technologies used in the production of wellboats, sequencing of salmon pathogen genomes, development of vaccines to control some salmon infections and replacement of fishmeal ingredients by vegetable-derived alternatives in the formulation of salmon feed. Furthermore, the experience gained so far is now being used to develop technologies needed to farm other fish species.

As a result of these measures, salmon production in Chile grew about 17-fold between 1990 and 2002. Its share in the global production of farmed salmon and trout increased from about 10% in 1990 to about 35% within the same period. Indeed, Chile has moved from being a learner to a major player in the production and marketing of salmon products. The industry's exports increased from about \$291 million in 1993 to about \$1.4 billion in 2004. Chilean salmon is now being exported to new markets in Asia and Eastern Europe.

The export products have also evolved from mainly frozen tailless and beheaded salmon that were easier to process, store and transport to the export of value-added products. As technologies for processing and packaging various fish products were acquired and/or developed, the ratio of value-added product increased from about 23% to 69% of total salmon industry exports between 1994 and 2004.

FDI played a marginal role in the early development phases of the industry. However, the entry of large foreign firms into the Chilean salmon industry in the last two decades has facilitated the introduction of new technologies and the expansion of production, fostered vertical integration and increased the average size of firms. It is estimated that about \$300 million of FDI was invested in the industry between 1989 and 2004.

The industry has also contributed to the general development of the region. Currently, it employs about 45,000 workers directly and indirectly, and has brought about a general improvement in regional infrastructure and services. More importantly, the poverty index of Region X decreased from 40% to 13% between 1990 and 2000 while the index of extreme poverty decreased from 24% to 7% over the same period.

These development gains may partly be explained by the nature of salmon industry expenditure. About 53% of the industry's expenditure goes to goods and the remainder goes to services. This means that a large proportion of the money raised is spent in the producing regions. This has led to the emergence of egg producers, feed manufacturers and providers of services. Many of these subsectors have attracted young professionals seeking employment opportunities in the once rural community. Taken together, they have contributed to the development of the region.

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