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Technological Innovation Studies Program

Research Report

MANUFACTURING UNDER LICENSE IN CANADA

by

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School of Business Administration,
University of Western Ontario
February, 1975

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Industry, Trade and Commerce
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The views and opinions expressed in this report are those of the author and are not necessarily endorsed by the Department of Industry, Trade and Commerce.

Abstract

This thesis evaluates the practice of manufacturing under licence, as it is carried out by the largest Canadian owned secondary manufacturing firms. The concern is to determine three things: (1) the conditions under which these firms license; (2) the viability of licensing as a strategy in terms of long term growth potential under different conditions; and (3) whether or not licensing is a viable alternative to the establishment of an in-house research and development competence.

The research model is constructed on three bases. The first is a general model of licensing, with attention paid to the type of information transferred, licensing motives, and the type of agreements possible. The second base is the competitive problem of the Canadian owned manufacturing firm as described by Crookell. His thesis that the competitive problems of the Canadian owned firm stem from its inability to operate in conditions of high uncertainty is taken as the focal point of the research. The final input to the research model is the conceptual work of Wrigley. His concept of core skills and integration between the research and production functions forms the underlying conceptual strength of the thesis. His concern with the uncertainty of the environment is akin to that expressed by Crookell and forms a strong bond between the problem context and the conceptual model applied to it.

The data to test the research model was collected from those of the 50 largest public Canadian owned secondary manufacturing firms which are acquiring product related technology under licence agreements. The data were collected in interviews conducted by the researcher.

The first conclusion of the research is that manufacturing under licence is a viable growth strategy for firms only receiving a one

time transfer of technology from the licensor. The second conclusion is that for firms with a low in-house research and development competence which rely on the licensor for a continuing transfer of technology, licensing is not a viable growth strategy. Thus manufacturing under licence is not a viable alternative to the establishment of an in-house research and development competence.

Acknowledgements

Many men gave up many hours that this thesis could be written. The thesis represents an interface between the business school and the business community, with each side making a large contribution to it. Senior businessmen donated freely of their time to participate in the research. The research interviews were exciting and interesting and the data gathered in this way is a backbone of the research.

On the other side of the interface is the academic world. There is at Western in the Business Policy area a very free exchange of ideas, accompanied by an attitude of openess and honesty, and a willingness to take risks in research. My thesis supervisor, Professor Nick Fry, both as area group member and Associate Dean, is in large part responsible for this mood, which contributed greatly to this thesis. Another essential ingredient to this mood in the school are fellow doctoral students willing to help one another and willing to discuss thesis ideas anywhere, any time. In this regard I thank Kenneth Dundas, Robert Falconer and Peter Richardson.

Professor Fry played a central role in helping me to keep my equilibrium when one side or the other of the interface seemed to be overwhelming. His perspective, developed from years of experience, allowed me a perspective beyond my years. He also played an instrumental role in arranging the funds to support the research.

Financial support provided for the three years of the doctoral program by Shell Canada and the Canada Council is gratefully acknowledged. Thanks are also due to the Department of Industry, Trade and Commerce who supplied the financing for the research project.

Finally, my wife Rebecca has given me outstanding support.

Not only have there been no complaints at the three years of poverty, but her enthusiasm for the course and my work has made the whole period one of the most enjoyable of our lives. May all doctoral students be so blessed!

Peter Killing

London, Canada

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Chapter One

1. Origins of the Research

This research began with a single question - is manufacturing under licence a viable growth strategy for Canadian owned firms? The question first arose for this researcher in mid 1973, the result of two strong stimuli. One was a research model constructed and tested by Len Wrigley and Harold Crookell dealing with the transfer of technology.[1] The other was the Gray Report, Foreign Direct Investment in Canada.[2] Both considered the question of manufacturing under licence, and each came to different conclusions regarding its viability as a growth strategy for Canadian owned firms.

The model developed by Wrigley and Crookell centered on the technology transfer process - comparing the process within the firm with that which takes place across the market. Their argument was that the technology transfer process is more efficient within the firm than across the market. A portion of the model is reproduced below.

> The institutional arrangements for transmitting technology are of two quite different kinds; administrative relations within a firm, and market relations between firms.
> In recent years the large corporations have increased greatly their administrative efficiency in transmitting technology from their laboratories into their various factories, but there has been no corresponding increase in the efficiency of the market.[3]

To test this model in the field Crookell examined first the technology transfer process within several large U.S. based multinational firms. He concentrated on the technology flow between the central research and development laboratory and the U.S. product divisions, and also on that between the U.S. and Canadian product divisions. Secondly, he examined the efficiency with which technical information flowed between licensor and licensee in licence agreements involving Canadian owned licensees. Although a formal measuring system was not devised, Crookell's observations led him to the opinion that the model was correct; the technology transfer process is more efficient within the large corporation than across the market in licensing agreements.

In the course of the field work Crookell concluded that three dimensions of the efficiency of the technology transfer are important; the speed of transfer, the cost of transfer, and the scope of the information transferred. His conclusions were framed with reference to these three dimensions of efficiency.

> ... the cost of technology to these firms (the Canadian owned licensees) on the open market seemed to be higher than the cost through a single administrative unit, such as multinational enterprise; the speed of transmission was probably a good deal slower; and the range narrower.[4]

These tentative findings lead to the conclusion that licensing would not be a viable strategy for Canadian owned firms competing with foreign subsidiaries in situations in which the efficiency of the technology transfer process is important.

The authors of the Gray Report approached the subject in a

different manner and arrived at a different conclusion. The Gray Report took the position that new technology is important for the growth of the economy. This new technology can be either created domestically or imported. Perhaps because of the failure of government incentives to raise the very low level of research and development spending in Canada, of which more will be said shortly, the Gray Report maintained that the import of foreign technology is of prime importance. The exact words were:

> The ability to obtain technology abroad at the most reasonable cost and apply it in Canada as effectively as possible is perhaps even more important than domestic technological development.[5]

Having decided that access to foreign technology is important, the authors of the Report considered the cost and benefits of three methods of obtaining foreign technology. These were direct investment by foreign companies in Canada, importation of finished products, and licensing agreements between Canadian firms and foreign owners of technology. Direct importation was dismissed as having very little benefit for Canada. The following passage outlines the comparison which was made between licensing and direct investment.

> The value of licensing arrangements involving the use of foreign technology ... lies in the fact that they may impose fewer restrictions (than direct investment) on the activities undertaken in Canada and results in greater benefits to Canada. More generally, these techniques permit greater Canadian influence over the industrial activity involved... and also give Canada the benefit of superior foreign inputs. The licensee is generally left some latitude in management, production, procurement, sales and pricing. He is freer and more likely to "shop around"

> for various inputs, including the pursuit of alternative sources of technology if other preferable sources exist or arise at a later date.[6]

This passage contains arguments suggesting that licensing may be of benefit for Canada, but also suggests that it will be of benefit to Canadian licensees. In comparison with subsidiaries, licensees have a choice of parents in that they can shop around for a new technology supplier, reacting to the changing fortunes of licensors. In addition, it is stated that licensees have fewer restrictions placed on them by licensors than subsidiaries do by their parents. With reference to this last argument, a statement by Crookell is of interest.

> The point to be made is that Canadian owned firms, securing technology through licence agreements, may be more constrained by and dependent upon their licensors, than foreign subsidiaries are on their parents.[7]

These sharply conflicting attitudes toward the viability of the licensing strategy and the conditions under which Canadian owned firms license were the prime motivation for this research. Neither the Gray Report nor the research done by Wrigley and Crookell were centrally concerned with the licensing question. Each made generalizations concerning licensing which ultimately led to opposing conclusions. This researcher felt that the truth most likely fell between the two positions outlined, that in all likelihood licensing was a viable growth strategy in some situations but not others. The research question was expanded to reflect this concern.

Under what conditions is the acquisition of technology under licence agreement a viable growth strategy for Canadian owned manufacturing firms?

This, then is the primary research question. There is however one "condition" which is of particular importance, and this will be discussed further here. In a variety of documents, including both the Gray Report and Crookell's article, the point is made that the research and development competence of firms operating in Canada is low, particularly of those firms which are Canadian owned. The data pertaining to firms operating in Canada, taken from the Gray Report are presented in Figure 1-1.

Figure 1-1

R&D Expenditures in Selected Canadian and U.S. Industries, 1967.
(as a percentage of sales)

	Canada	U.S.
Chemicals and Allied Products	1.8%	2.6%
Petroleum and Coal	1.1	1.4
Rubber and Plastic Products	.6	1.1
Non Metallic Minerals	.3	.8
Primary Metals	.7	.4
Metal Fabricating	.2	.4
Machinery	.7	2.1
Electrical Products	3.6	6.3
Transportation Equipment	.9	6.3

Source: Gray Report Table 19 converted to percentages.

This chart shows that in every industry except primary metals, firms in the U.S. spend a higher percentage of sales on research and development (R&D) than firms in Canada do. In most industries the difference is very great.

The data segregating research and development expenditures by ownership for firms operating in Canada are available for a single year, 1967. The information is shown in the Figure below.

Figure 1-2

R&D Expenditures in Canada, 1967

(millions of dollars)

	by Cdn. owned firms	by for. owned firms
Mines and wells	7.0	4.0
Chemical based	4.1	56.5
Wood based	8.6	8.2
Metals	20.6	3.6
Machinery and transport	6.6	48.7
Electrical	42.5	49.2
Other manufacturing	7.7	5.1
Total	97.1	175.3
as a % of 1967 sales	.23%	.75%

Source: CALURA, Part 1: corporations, 1968.

These figures show that the overall Canadian averages presented in Figure 1-1 are raised by the R&D spending of foreign subsidiaries operating in Canada. On average, Canadian owned firms spend only .23% of sales on research and development. These figures are supported by data collected by Safarian, who found that in a sample of 96 Canadian owned firms, 39 spent no money on research and development at all, 60 spent less than one half of one percent of sales and only 11 spent over 2 percent of sales on R&D.[3]

It has been suggested by a variety of researchers that the lack of research and development work carried out by Canadian owned firms has hindered their growth and development in the Canadian market, as well as internationally.[9] For this reason one subset of the overall research question will receive particular attention, namely; is the

acquisition of technology under licence agreement a viable alternative to the development of an in-house research and development competence?

2. The Research Method

The purpose of this section is to outline the research performed, giving some insights as to why the research has taken the particular form that it has. Very little formal research has been done on licensing. Virtually none has been done from the point of view of the licensee. In that respect this research is unique and exploratory in nature. Because of this lack of previous research it was decided to operationalize the research question by dividing it into two sections. The initial concern of the research is with the conditions under which Canadian owned firms license. Only after these have been determined is the judgment made as to whether or not they offer the licensee reasonable growth potential.

The intent of the research model, presented in Chapter Four, is to establish, on a strong theoretical base, significant categories of licensees, and to create hypotheses concerning the conditions under which each will license. Several major resources were available for use in the development of the research model. Foremost among these was a conceptual model by Wrigley dealing with the integration of research and development and production facilities.[10] This model was a further development and broadening of that discussed in the previous section. This is presented in Chapter Three. Also presented in Chapter Three is material drawn from Crookell's thesis,[11] which analyzed the competition between Canadian owned and foreign subsidiaries in product life cycle terms. This analysis was accepted and used as the context in which the licensing issue was examined. Conclusions as to the suitability

and validity of the interpretations made by this researcher of the work of both Wrigley and Crookell is presented in the latter portion of the thesis. Finally, Chapter Two contains an analysis of the diverse literature relevant to a study of licensing, including technology transfer studies and legal concepts, as well as literature dealing directly with licensing. This material is distilled into a model of several licensing types and situations where they are most commonly used.

Since there were no data publically available indicating which Canadian owned firms operate as licensees, the largest 50 Canadian owned secondary manufacturing firms were contacted and data collected from those which indicated that they were acting as licensees. Characteristics of the respondents are given in Chapter Five. The data necessary to test the hypotheses developed in Chapter Four are also presented in Chapter Five, along with the statistical tests to determine the validity of the hypotheses. Since the data were obtained by interview, a large amount of descriptive non quantitative data were collected and these are used in Chapter Six to provide an analysis of motives, attitudes, and corporate strategies of licensees. Chapter Five has presented the conditions under which Canadian owned manufacturing firms act as licensees, Chapter Six presents their reasons for doing so.

In Chapter Seven judgments are made as to whether or not licensing is a reasonable growth strategy for each of the types of licensee identified in the research. One of these types consists of firms which are obtaining technology under licence on a continuing basis instead of developing an in-house research and development competence, so in this way the question as to whether or not acting as a licensee is a viable alternative to developing an in-house research and development competence is answered. The thesis ends with the

presentation of new hypotheses concerning the existence of a licensing cycle by which it is postulated firms can use licensing as a vehicle to develop an in-house research and development competence at less risk than if they were to attempt to develop such a competence without acting as a licensee. Further research is recommended into the licensing cycle model.

3. Extent of Licensing in Canada

The intent of this section is to round out the introductory chapter by giving an indication of the extent of corporate licensing in Canada. The data to do this have only recently become available, in the Statistics Canada Balance of Payments Report for the third quarter of 1973. Prior to this there were no data available on the extent of licensing in Canada.

The Statistics Canada survey was mailed to the approximately 6,000 firms in Canada which are regularly contacted for balance of payments information. The questionnaire dealt with licence agreements in which the firms were involved in 1972. The response rate was approximately 90% and 3417 licences relating to the acquisition of technological know how were reported by 760 firms. One third of these licences were from affiliates outside Canada. The chart below indicates the nationality of the licensors, as well as the industry of the licensees, by licence agreement.

Figure 1-3

Licensing Agreements Involving Canadian Enterprises, 1972.

(By country of control and enterprise industry of licensee)

	Petroleum	Manu-facturing	Mining	Merchan-dising	Finan-cial	Other	Total
			By all enterprises				
Licences reported	164	2,523	49	483	10	188	3,417
Licences by country of residence of licensor:							
Canadian subsidiary of foreign company	4	108	7	24	-	2	145
Other Canadian licensors	4	128	4	9	-	7	152
United States	142	1,893	29	394	9	156	2,623
United Kingdom	4	103	1	29	-	4	141
Europe	7	250	6	25	1	15	304
Japan	2	13	-	1	-	-	16
Other	1	28	2	1	-	4	36
Licences held from affiliates:							
In Canada	-	33	-	5	-	63	101
Outside Canada	38	751	1	308	3	53	1,154

Source: Statistics Canada, Balance of Payments Report, 3rd. quarter 1973.

Of particular interest to this research are the 2523 licensing agreements involving manufacturing firms. A further breakdown of these by country of control of the licensee is given below.

Figure 1-4

Licensing Agreements Involving Canadian Manufacturing Enterprises

1972

By Country of Control of Licensee

Licensee	No. of Agreements			
	Total	With non-Residents	Payments to non-residents ($000's)	Average payment per licence ($000's)
Canadian controlled	510	462	5,806	12,568
U.S. controlled	1,632	1,469*	76,913	52,357
U.K. controlled	232	211	5,493	26,033
Other non-resident	149	145	7,552	52,083
Total	2,523	2,287	95,764	

* 695 of these were with affiliated companies.

Source: Statistics Canada, Balance of Payments Report, 3rd quarter 1973. Average payments calculated by researcher.

It is interesting to note that the average royalty per agreement is sharply lower for the Canadian controlled firms than the others. This could indicate that Canadian controlled firms make less use of their licence agreements (i.e. have lower sales per agreement) or have agreements with lower royalty rates, which is generally the case if the technology received under the licence is not the result of a recent development. This research may shed some light on this question, but it will not be definitive, since this is not a comparative study and only licences held by Canadian owned firms will be examined.

The preceding data were as fine a breakdown as was published by Statistics Canada. However in response to a request for an analysis of the 462 licence agreements between non residents and Canadian controlled firms the following information was provided.

Figure 1-5

Size Distribution of Payments to Non Residents by Canadian Controlled Manufacturing Licensees in 1972

Size of Payment	Licences	Enterprises	Payments to Non Residents ($000's)
No payment	14	8	Nil
under $50,000	287	19	346
50,001 to 100,000	25	6	471
100,001 to 150,000	50	7	888
150,001 to 250,000	46	9	1,878
250,001 to 650,000	40	5	2,223
Total	462	54	5,806

Source: Information supplied to researcher by Statistics Canada, Balance of Payments Section.

These 54 firms are of primary interest to this research. Unfortunately their identity could not be revealed by Statistics Canada, and this resulted in a rather inefficient data gathering procedure, of which more will be said later.

A final set of data of interest collected by Statistics Canada is that indicating the percentage of total sales made under licence by all of the reporting firms.

Figure 1-6

Share of Sales Revenue Accounted for by Products or Services Produced Under Licence, 1972

Share of Sales Revenue	Licences	Enterprises	Payments to Non Residents ($000's)
	(number)		
Under 10%	1,674	253	16,112
10% to 20%	364	75	10,678
21% to 30%	255	46	5,521
31% to 50%	265	65	8,996
51% to 75%	180	69	23,835
Over 75%	679	249	53,730
Total	3,417	757	118,872

Source: Statistics Canada, Balance of Payments Report, 3rd Quarter 1973.

As can be seen, the distribution is bi-modal, with almost the same number of firms producing over 75% of sales under licence as producing less than 10% of sales under licence. Speculation on these figures would suggest that most Canadian owned medium and large firms will be in the under 10% class, whereas the over 75% class would be made up of either small firms with a narrow product line, or foreign subsidiaries whose product lines are produced under licence from the parent companies. The speculation with respect to large Canadian owned firms will be tested in this research.

A second point of interest in this table is that close to 120 million dollars was paid in royalties to non residents in 1972. Considering typical royalty rates this probably represented between 3% and 7% of the sales made under licence. This would suggest that sales made under licence in Canada in 1972 were between 1.7 and 4 billion dollars.

The quantitative data presented in this section is just about the sum total of the knowledge of licensing in Canada. Why firms are licensing, the type of products being licensed, the competition faced, the restrictions enforced by licensors, and most importantly the potential growth of products made under licence, are unknown. This thesis will supply answers to many of these questions while driving toward a judgment on the overall issue, - under what conditions is the acquisition of new technology via licence agreement a viable growth strategy for Canadian owned manufacturing firms?

Chapter One

Footnotes

1. This research model was contained in a University of Western Ontario memo dated February 7, 1972, authored by Harold Crookell and Len Wrigley.
2. H. Gray, Foreign Direct Investment in Canada, (Ottawa, Information Canada, 1972).
3. Crookell and Wrigley, p. 1.
4. H. Crookell, "The Transmission of Technology Across National Boundaries", The Business Quarterly, Autumn 1973, p. 57.
5. Gray, p. 116.
6. Ibid., p. 467.
7. Crookell, p. 52.
8. A.E. Safarian, Foreign Ownership of Canadian Industry, (Toronto, McGraw-Hill Company of Canada, 1966), p. 279.
9. See for example, P.L. Bourgeault, Innovation and the Structure of Canadian Industry, (Ottawa, Information Canada, 1972); Innovation in a Cold Climate: The Dilemma of Canadian Manufacturing, (Ottawa, Information Canada, 1971); and the Senate Special Committee on Science Policy, A Science Policy for Canada, (Ottawa, Information Canada, 1972), Volume Two, p.p. 599-602.
10. This model was titled, R&D and Production: Model Predicting Relationships in Various Economic States, and was presented in an internal University of Western Ontario memo dated February 1974.
11. H. Crookell, The Role of Product Innovation in Trade Flows of Household Appliances Between Canada and the U.S.A., unpublished Ph.D. thesis, University of Western Ontario, 1970.

Chapter Two

The purpose of this chapter is synthesis. The objective is to draw together the varied concepts and variables relevant to a study of licensing, as they occur in a wide variety of literature. At the same time as some material is selected for inclusion in the licensing model presented at the end of the chapter, other material is explicitly rejected. In this way the first steps toward an operational definition of licensing are being taken.

The licensing model developed in this chapter focusses on the identification of the participants in Canadian licence agreements, the type of information flowing between licensor and licensee, and some of the significant clauses in licence agreements. In order to identify probable participants in a licensing agreement, literature suggesting motives for firms to enter licence agreements has been examined. Categories of licensing firms are developed only after it has been determined why the firms are licensing. The literature of technology transfer has been studied to provide a meaningful breakdown of the content of the information flow between the parties in a licence agreement. Finally available material on the form of the agreement itself, particularly restrictive clauses, has been searched for relevance to the model.

The chapter begins with the view of licensing taken in the legal literature.

1. Licensing - The Legal Concept

In law, the subject matter of licence agreements falls under the classification of industrial property rights. This is a generic term covering rights pertaining to both tangible and intangible industrial

property. However, the legally enforceable rights which pertain to intangible property such as patents, trademarks, and 'know how' are substantially different from the legally enforceable rights which pertain to tangible property such as physical plant and machinery. For this reason, many legal authorities have gone one step further and considered the subject matter of licence agreements to be classed as intellectual industrial property rights. Intellectual industrial property is that created by the exercise of the human intellect. Eckstrom elaborates:

> Patentable inventions, trademarks, know how, and technical data all are created either by the imagination of a creative mind, by perceptive selection of data useful for a special purpose from a larger mass of data, by the drawing of new conclusions from a mass of data, or from other types of intellectual perception of new truths which arise from the contemplation of physical phenomena.[1]

The distinction which now must be made is between statuatory and non-statuatory rights, both of which are included in the above quote. Statutory industrial property rights are those that are established by patent, trademark, and copyright laws and similar statutes. Know how tends to be used as a generic term to describe all industrial property rights which are non-statutory. There is no firm legal definition of know how, but it is generally considered to include, "technical data, technical aid, technical assistance, and any other means which is capable of increasing the ability of the recipient to carry out, manufacture, or perform any other form of industrial procedure or process."[2]

In trying to reach a common definition of licensing which would be valid across the wide number of permutations and combinations possible in a licensing agreement, Eckstrom stated the following:

> The common denominator of all licence agreements may

> be expressed in the following terms: the licensee receives from the licensor, for an agreed consideration, the right to enjoy something which the licensor has the right to grant, without interference by the licensor. The essential element in the creation of a licence ... is a permission or consent by a licensor which may be oral or written, with or without monetary consideration, and expressed or implied. 3

The essence of the intellectual industrial property rights licence agreement is therefore the consent by one party to grant to a second party something which has been created by the exercise of intellect and which the first party has the right to grant.

This definition is very broad, and cannot be used operationally for this research. As indicated earlier, the purpose of this chapter is to move away from such general statements toward specific operational definitions which can be used to guide the research. To begin, it must be stated that this research will not consider licensing agreements which do not involve manufacturing on the part of the licensee. Eckstrom's broad definition of licensing would include franchise agreements, foreign distribution agreements, and a variety of other licensing situations which do not necessitate that the licensee manufacture the product; such things as these will not be considered further here.

As a first step to identifying types of licensing agreements, the motivation of both parties to the agreement will be considered. This will allow the most likely candidates for participation in a licence agreement to be identified.

2. The Motivation to License

This section explains why licence agreements are made. The viewpoint of both licensor and licensee is presented. It must be

emphasized that the determination of corporate licensing motive is not a primary objective of this research. Motive is used in this chapter to develop categories of licensing firms, and some of this work is carried forward to the research model of Chapter Four. Although none of the formal hypotheses involve motive, data collected on licensing motive are presented in Chapter Six.

(a) The Licensor

There is no shortage of literature concerning the motivation of the licensor in entering a licence agreement. The challenge in this section is to categorize the variety of motives suggested in the literature.[4] Four categories have been established, presented in the following sections.

(i) Inventor - Corporation:

The motivation propelling some licensors to license is simply to get an invention put to commercial use. This situation may arise when an individual or small firm makes an invention and secures the patent for it, but does not have the resources to develop the invention any further. As a result the inventor searches to find a firm which is capable of developing and profitably exploiting the invention. In this situation the licensee has complete control over the manufacture and marketing of the product, while the licensor has only to maintain the validity of his patent and ensure that he is receiving his royalty as stipulated.

There are some Canadian data available on the role of the individual inventor. It is not a large role. Only 7.2% of the Canadian patents issued in a three year period centered around 1960 were to individual inventors. Over 90% were issued to corporations. Even when the individual inventor does receive a patent it is licensed to a Canadian firm only about 10% of the time. As Firestone reports:

> In one out of ten cases, the independent inventor will license the invention with Canadian firms. In the remaining nine cases, he will either be unable to license the invention because there are no takers, or he will license it to non-Canadian firms or he may dispose of it through sale, or he may work it himself. [5]

To summarize, the motivation for the small firm or inventor is to license his patent to a firm capable of using it profitably, in order that the inventor will receive some royalty income.

(ii) Corporation - Corporation:

The classic licensing situation is that between two corporations, one of which produces a product in its domestic market while licensing a second company to produce the product in a foreign market, giving to the second company the legal right and technical know how it needs, in exchange for a royalty expressed as a percentage of the sales of the product made by the second company. The point of view of the licensor in this licensing situation is examined by most international business texts. These texts typically compare the alternatives open to the first company (joint venture, licensing, wholly owned subsidiary) of expanding into the foreign market.[6]

In these analyses licensing is considered to be an option involving a relatively low commitment of capital and management on the part of the licensor, and the one which carries the least political risk. On the other hand licensing does contain the risk that the licensee will learn a lot from the licensor and in the end become a significant competitor. Generally the motivation of licensors in such situations is to increase their profitability by capitalizing on a distinctive competence developed in the domestic market. Often this competence is in research and development. Friedmann and Kalmanoff comment on

Westinghouse's licensing program, designed to make use of the company's strong R&D function.

> Some companies, of which Westinghouse is a prime example, have specialized in licensing as the preferred form of joint venturing. The reason is the disinclination to commit large amounts of capital abroad - especially in view of the capital-intensive nature of the industry and the high cost of new plants - and because of the research program being conducted. The research and development effort is so extensive and successful that Westinghouse can count on retaining a long lead in product development over its licensees, thereby minimizing the risk that the technology transferred will build up a dangerous rival, or that the licensees will wish to terminate the relationship at the end of the licensing period. 7

Freidmann and Kalmanoff indicate that the motivation for firms such as Westinghouse to license is the avoidance of risk; in this case, the avoidance of a heavy overseas investment program. These authors state that licensing is the least profitable strategy for entering a foreign market. Thus in considering the licensing motivation for firms in this category it is not enough to state profit maximization alone, but rather the best profit possible at an acceptably low level of risk.

As a final note it should be mentioned that the very carefully structured trade off analysis in international business texts is becoming increasingly obsolete as an ever larger number of countries decide that certain alternatives, such as direct investment, are not available to foreign firms. Regardless of its relative profitability, licensing is likely to become of increasing interest to firms wishing to enter foreign markets, because of the increasing nationalism in many countries.

(iii) Cross Licensing:

Cross licensing takes place between corporations, but in this

case the motive is not to earn royalty payments, but rather to trade research results, that is, to exchange patents and know how not for cash, but for other patents and know how. This practice is followed in a large U.S. pharmaceutical firm, as indicated below by one of its senior executives.

> Our company's products are placed in a heirarchy by technology and high technology products are not normally licensed except on a cross licensing basis, with other major pharmaceutical firms. In general, we prefer to market our own products, as long as those products fit our marketing expertise. As a result licences are not granted primarily for cash. Our view is that technology is scarce, breakthroughs are rare, and our licensing policy is to exchange our technology for others, usually at an intermediate stage of technological development.

Cross licensing agreements are usually made between two firms of similar standing in related fields of industry where technologies are advanced and R&D costs are high. The motivation is to gain scientific information which will further advance one's own R&D program.

(iv) Within the Corporation:

There is a large class of licence agreements which will not be considered in this research, but which should be mentioned here because of their frequency of occurrence and of mention in the literature. This is the parent-subsidiary licence. This type of licence is now the norm in multinational firms. A U.S. survey carried out in 1959 indicated that less than 20% of the wholly owned subsidiaries of over 200 major U.S. multinational firms did not have licensing agreements with the parent.[9] These licences are used to transmit developments made by a centralized R&D or engineering group to subsidiaries throughout the world. The reasons for using the formality of licence agreements are

generally legal or financial, often involving the avoidance of income tax. Behrman commented on these in his article Foreign Investment and the Transfer of Knowledge and Skills:

> Though it is perfectly feasible for a U.S. parent company to permit its wholly-owned subsidiary to use all tangible and intangible assets, such as patents and trademarks, it may not be advisable to do so. A company using a trademark registered in the United Kingdom must be a "registered user", and a licence agreement provides the necessary documentation. In the event of sale or nationalization of the company, it is possible that continued use of patents or trademarks may be construed as having given the subsidiary property rights in them which the courts would consider as part of the acquisition of the buyer. A formal agreement would help prevent such a misunderstanding.
>
> For financial or tax reasons it is sometimes desirable to license a wholly-owned subsidiary. Thus, formerly at least, exchange restrictions tend to favor remission of dividends. Also, when the parent company is not necessarily eager to remit foreign earnings back to the United States, a tax advantage arises from local currency payments of royalties under a licence. Royalties are frequently considered an expense to the licensee and thus a deductible item and so long as the payments are kept abroad, the income bears no tax. 10

For purposes of this research it is enough to know that such agreements are in use and that the motivation for them is technical, having to do with corporate law and taxation. This research will consider only agreements which are arm's length transactions.

Having considered three types of licensing which are of further interest to this research and one which is not, it is now appropriate to examine the motives which lead a potential licensee to enter a licence agreement.

(b) The Licensee

In the previous section the challenge was to categorize the

many motivations for the potential licensor suggested in the literature. The situation in this section is quite different. Few authors are willing to commit themselves to reasons why licensees enter licence agreements. Brazell in his book Manufacturing Under Licence begins with a promising opening sentence reacting to the lack of attention which has been given to the licensee:

> Most writings on licensing treat the subject from the licensor's point of view; indeed, one might be forgiven for getting the impression that licensees are a special breed of meek, smallish companies which are always available to accept gratefully on stringent terms such favours as imperious licensors deign to grant in consideration of the payment of princely "disclosure fees" or onerous rates of royalty. 11

Unfortunately Brazell then goes on to outline the process by which a licensee should enter an agreement, rather than suggesting specific reasons why it would want to.

Eckhart states that the reasons licensees enter into licence agreements are "many and too well known to list".[12] He does suggest, however, that one of the main motivations of licensees is that they cannot match the R&D output of licensors in terms of inventions, know how and technical data. This theme that the licensee is licensing to obtain a source of R &D output is further developed by G. Bloxam, who creates what he describes as a "licensing in equation."[13] This equation lists the factors to be considered in making the trade off between doing research oneself and buying the results of someone else's research. The terms of the "equation" are shown below:

Figure 2-1

Terms of the Licensing-In Equation

IN FAVOUR OF TAKING A LICENCE	AGAINST TAKING A LICENCE
1. Cost of own R&D - cost of experimentation to achieve objective X probability of failure.	1. Cost of R&D to adapt and operate licensed technology.
2. Length of time required for 1.	2. Length of time required for 1 from beginning of negotiations.
3.	3. Benefit of strengthening own research effort.
4. Strong patent situation.	4. Weak patent situation.
	5. Consideration to be paid for licence.

Source: G.A. Bloxam, Licensing Rights in Technology, Chapter Three.

It should be noted that the terms of the licence (other than the financial consideration) do not enter the equation. Bloxam explicitly states that he considers the main decision to be whether or not to take a licence and assumes that the terms of the agreement are not a deciding factor. This is generally the same position as taken in this research, with the exception of a few terms of special interest which are examined in a later section.

The factors in Bloxam's "equation" are largely self-explanatory. It is interesting that he assumes an R&D capability is needed to adapt andcperate the licensed technology. This point will occur again later in the research. The patent position referred to in point four is that of the licensor. If it is strong it is hard to design around it, if it is weak it is not as difficult. The huge unknown factor in the trade off is the cost and time required to do the research oneself. For firms with no R&D capability the estimate is likely to be almost impossible

to make, as it would have to include hiring qualified personnel, buying equipment, and organizing the two to work on the problem. Even firms with an existing research capability which know the competences of their research personnel would find it difficult to make an estimate in which they felt any confidence.

The existing literature on licensees' motivation for entering licence agreements, as reviewed above, seems to this researcher to be vague and the analysis suggested unrealistic. The question which must be answered is why the licensee enters the licence agreement. Do all licensees enter agreements for the same reasons? What does the licensee actually receive from the agreement? With the intention of getting some better answers to these questions the following section analyses licence agreements from a technology transfer viewpoint. That is, the emphasis is on the information flowing between the two firms. Once it is determined what the licensee receives from the agreement, his reasons for entering it may be clearer.

3. Licensing as Technology Transfer

The purpose of studying licensing from a technology transfer viewpoint is to determine the type of information which is passed between two companies in a licence agreement. The type of information flowing will vary, depending upon the levels of the firms at which communication is taking place. The section begins with a general description of technology transfer and then moves into detail in areas of specific relevance to this research.

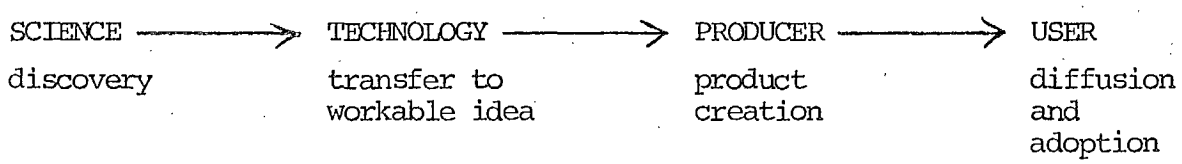
Definitions of technology and transfer vary with time, place and scholar. Research in this area has been largely problem oriented and definitions and concepts have been developed appropriate to the

problems at hand. The two major problems which have given rise to the spate of studies concerning technology transfer in the 1960's have been the lack of transfer between the nations of the world (leading to the "technology gap"), and the claimed lack of transfer between the U.S. space program and U.S. industry by critics of the space program.

In the face of such a wide variety of definitions and concepts the first objective of this section is to create a framework which can be used to organize the diverse literature on the subject literature of technology transfer. Definitions broad enough to cover a wide range of application are so general as to be meaningless. That provided below, arising from the 1966 M.I.T. conference, "Human Factors in the Transfer of Technology", is a case in point.

> Technology may be defined as the means or capacity to perform a particular activity. The transfer of technology must then mean the utilization of an existing technique in an instance where it has not previously been used. 14

In order to come to grips with the concept of technology transfer it is necessary to consider the stages through which an idea passes before it becomes commonly used as product or process. The M.I.T. conference developed the following fairly simple but useful scheme.[15]

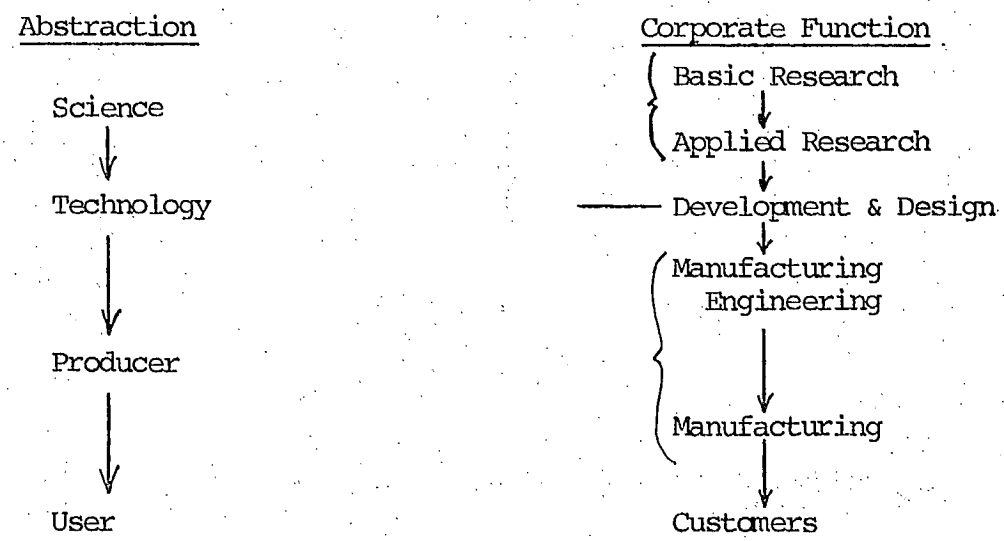


In order to construct a framework which can be used to categorize technology transfer studies, this classification can be related to the more familiar corporate functions. This is done below, using the corporate functions suggested by Morton in his study of technology flow

within the firm.[16] The pairings are somewhat approximate, but sufficient for general classifactory purposes.

Figure 2-2

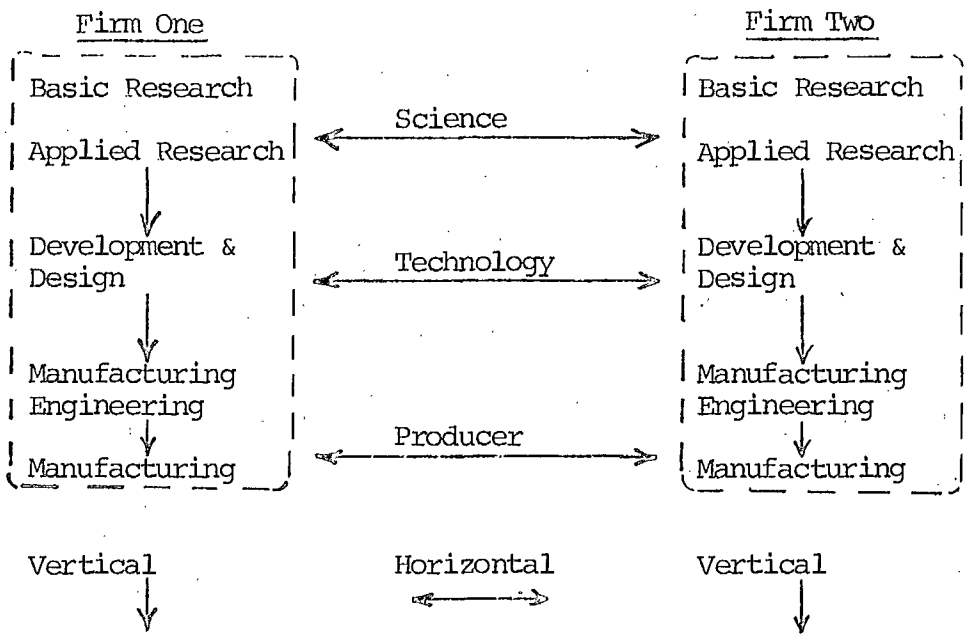
Technology Flow



If this diagram is expanded to include two firms, and the potential internal and external flows of technical information are indicated, two kinds of technology transfer can be distinguished which will greatly facilitate a sorting of the literature on the subject. The two types of technology transfer to be identified are vertical, or inside the firm, and horizontal, or between firms.[17] Since the focus of this research is on transactions between firms the customer, or user in the M.I.T. conference's terminology, is omitted from the classification. The diagram below indicates the basic elements of the scheme.

Figure 2-3

Horizontal and Vertical Technology Transfer



The diagram shows horizontal technology transfer taking place at three levels between firms, and vertical transfer between each level within a firm. The necessity for an efficient transfer of technical ideas within the firm is well recognized, and considerable attention has been focussed on the process. Work of particular interest is that by Jack Morton of Bell Laboratories who believes in the need for organizational bonds between sections of a company which are spatially separated, and spatial bonds between those which are organizationally separated.[18] Crookell is another researcher who has concentrated on vertical technology transfer, in this case between the parent and subsidiary of the multinational enterprise.[19] His concern is with the accuracy, breadth and speed of information flows between the parties.

The work of Morton and Crookell reveals that firms themselves are well aware of the need for efficient information transfer within the organizational unit. While there are still problems to overcome and

refinements to be made, at least the objectives are clear and the barriers to success identified. Horizontal technology transfer, the flow of information between firms, has received less attention.

4. Horizontal Technology Transfer

Horizontal technology transfer takes place between firms, or possibly between a public research laboratory and a private firm. Figure 2-3 indicated that it can take place at any of three levels; science, technology, or producer. This classification is useful in understanding the differences in context and in definitions of technology transfer which arise in the literature. A different type of information is transmitted and received at each level. The following sections examine the information being transferred at each level, and indicate those levels at which licensing can take place.

(i) Technology Transfer at the "Science" Level

The technology transfer taking place at this level is the movement of scientific information between scientists and engineers of different firms, who are involved in research and development work. The major study in this area was carried out by Rosenbloom and Wolek of Harvard in the mid 1960's.[20] The purpose of the study, which included over 3000 engineers and scientists working in R&D labs., was to determine the means by which these professionals acquire technical information useful in their work. Methods of acquisition included areas such as professional journals, books, conferences, and chance conversations with fellow scientists.

Since they are working at a level where fairly abstract ideas are being communicated, it is not surprising that Rosenbloom's and Wolek's

definition of technology is abstract.

> Technology provides the means by which man interacts with his environment in the satisfaction of his needs. The essence of technology is cognitive, not material ... at its core technology is the embodiment of man's understanding of natural processes. [21]

Technology transfer at this level is not managed via licence agreements. There is nothing to licence. One of Rosenbloom's more interesting findings was that less than half of the useful information received by the scientists and engineers in the sample was specifically sought by them. The majority was pointed out by others or simply come across by accident. It is apparent that the only way for a firm to become part of this technology transfer process is to hire scientists and engineers capable of entering the dialogue. Commenting on the recent development of a basic research capability by the Ford Motor Company a company official stated:

> If you are to tap the world's science and technology you have to create some science. Your admission ticket to the club is to have something of your own to talk about. [22]

(ii) Technology Transfer at the "Technology" Level

As indicated in Bolt's flow diagram presented earlier the "technology" level is the workable idea stage. In the firm's hierarchy this corresponds to the development stage at which the objective is to turn workable ideas into commercially feasible ideas. The characteristic of information flow at this level which will be used to separate it from that at the "producer" level will be that the product or process to which

the information refers has not been commercially proven.

There are three commonly identified situations in which technology transfer at this level arises. There is the transfer between the small inventor and the larger corporation, a circumstance described in the earlier part of this chapter. A second occurs between the development departments of large firms, as would typically be the case in cross licensing agreements. Finally, transfer takes place between the public and private sector, as in the transfer from the U.S. space program to industry. The Canadian equivalent of this would be transfer from public research laboratories, such as the National Research Council, to private firms.

The only research at this level has been of the transfer between the U.S. space program and U.S. industry. The definition of technology arising from a study in this area by S. Doctors is interesting to compare with Rosenbloom's because it is so much more concrete.[23] According to Doctors, technology is "any tool or technique, any product or process, any physical equipment or method of doing or making by which human capability is extended".[24]

In contrast to technology transfer at the "science" level, licensing can be used as a vehicle of transmission at this level. This is because there is something concrete enough to license. Patents exist, formulae and processes are known. It is just that they have not yet been commercially proven. A final point that must be made is that the firm wishing to receive this kind of information (i.e. act as licensee at this level) must have its own development capability, as well as production and marketing facilities. Otherwise it will not be able to develop the product and bring it to market.

(iii) Technology Transfer at the "Producer" Level

The technology being transferred at this level is the technical information necessary for the recipient to begin production of a specific product, or begin using a specific process. The product or process is commercially proven before the transfer takes place. Once again the specificity of the information being transferred has increased. The transfer is now made via drawings, specifications, and process sheets. Pierre Bourgeault in his report for the Science Council, indicated in some detail the form and nature of technology transfer at this level.

> Except in the cases of extremely simple products, or back-yard garage operations, the technology that underlies a product and the processes involved in making it are embodied in a large number of engineering drawings and specifications. The actual number can range from a few dozen to many thousands, depending upon the complexity of the product. The day-to-day application of technology on the factory floor, in the quality control laboratory, in the purchasing office, etc., is done from these drawings and specifications. Engineering drawings and specifications will be made to describe the product itself with great precision and in great detail, including its performance and its characteristics under many sets of conditions; other specifications and drawings will be made to describe, again in minute detail, all of the materials and parts that must be used in making the product; still others will describe very precisely all of the operations and conditions that must be applied to the materials and/or parts so that they become transformed into the product; still others may describe, sometimes to the point of naming the supplier and model number, the production machines and tools that must be used. 25

This is the level at which licensing most commonly takes place. The licensee knows that the technology which he is receiving is commercially proven and can enter the agreement with some confidence. Even at this level though, the licensee will need some engineering competence, both to evaluate the technology being offered by the licensor, and to

adapt this technology to local conditions.

5. Licensing Motivation, The Licensee - Part Two

The preceding analysis of licensing from the technology transfer viewpoint has shed some light on the motivation of licensees to enter licence agreements. Two levels of technology transfer have been identified at which licensing can take place. The information transmitted at each level is different and the capability needed by the licensee to make use of the technology received at each level is different. If the licence agreement involves the transfer of technology not commercially proven at the "technology" level, the licensee must have an in-house development capability. If the transfer is at the "producer" level, thus involving commercially proven technology, all that is needed is a minimum level of engineering competence, to evaluate the technology and adapt it, if necessary, to local conditions.

The facade of anonymous identical licensees is being broken down. Firms do accept licences which yield them different types of information, and different motives for accepting licences may be imputed to them. To complete this process of motive identification information is needed on the form of licence agreements themselves. Some firms accept licences with significantly different clauses than others, leading again to the suggestion that there can be more than one motive for entering a licence agreement.

6. The Form of Licence Agreements

This research is not centrally concerned with the terms of licence agreements. Licence agreements are legal documents which must express the intentions of businessmen in a language meaningful to lawyers and judges. The businessman will often prefer to leave unlikely

contingencies out of the agreement, to keep it as simple as possible. This in general is not advisable. The following quote is from the introduction of Mason's book, Standard Clauses in a Licensing Agreement.[26]

> The snag with licence agreements is that the normal businessman wants a simple one or two page document, readily understood and with the minimum chance of misinterpretation. Such a licence does not exist. It is essential to foresee as far as possible what may go wrong... and that means a lot of clauses and a long agreement. There is simply no alternative. 27

The standard clauses of a licence agreement as presented by Morgan in his text are included in the appendix, and some of these will be referred to in this section. It should be emphasized that these clauses are not necessarily in all licence agreements, or that they may be turned around to favour the other party than the way Morgan has presented them. There is no intention here of examining all of the clauses (89 in total) listed in the appendix. However several clauses suggest differences in motivation on the part of the licensee and these will be examined here.

(i) Continuing or One Time Technology Transfer

In his article The Transmission of Technology Across National Boundaries, Crookell suggested that there are three major types of licensing, as outlined below.[28]

a) All technology currently developed or to be developed by the licensor.

b) All technology now in place by the licensor (the licensee must have in-house skills to develop future change himself).

c) Licence for a specific patented product, component, or process.

A close reading of these suggests that the first type is fundamentally different from the second and third in that it includes future technology to be developed by the licensor. In other words it is a lasting agreement, rather than a one time transfer of technology. The relevant clauses of Mason's sample agreement included in the appendix are 11 and 12. Crookell's observation was that Canadian owned firms employing the first type of licence, continuing transfer, never developed any technical capability of their own, and thus remained dependent on the licensor for even minor changes in technology. This led eventually to what is described below as a "foreman mentality in management".

> What was more discouraging was that the Canadian firms had avoided development of in-house absorption skills, and remained dependent on the licensor for even minor changes in technology. Often the licensor would send skilled technicians into the Canadian firms to iron out problems during the start up of a new product or the introduction of some new feature. Canadian firms receiving this help developed what one executive described as a "foreman mentality in management". Operations tended to be run on a day-to-day basis. Managers had so little control over the speed and direction of the licensor's research, that they were generally unable to formulate integrated long-range plans. 29

Crookell's comments on the inability of the licensee to formulate integrated long range plans will be returned to in a later section.

The preceding observations indicate that firms entering continuing transfer licence agreements are doing so in order to avoid the necessity of developing any technical competence of their own. Firms entering one time transfer agreements would not be able to rely on the licensor in this way. This clear and important difference in motive will play a part in the licensing model, and in the research model itself.

(ii) Export Restrictions

Many licence agreements contain clauses (such as 45 and 46 in the appendix) restricting the licensee to operating in his domestic market, or perhaps the domestic market plus one or two outside countries. It would be convenient in this research to be able to state that firms which accept licence agreements containing export restrictions are acting with different motivation than those which will not accept such agreements. Unfortunately this is overstating the case, as the following data indicates. Many firms, even when granted licences allowing them to export, do not take advantage of the opportunity.

Figure 2-4

Use of Market Access Potential
by Canadian Enterprises, 1972

Market access to	Number of countries exported to				No exports	Total
	One	Two	Three	Four or more		
	no. of enterprises					
All countries	47	16	12	57	85	217
All countries except source of licence ...	3	4	4	10	15	36
Some countries other than source of licence	24	12	7	20	47	110
Unallocable	1	4	1	12	10	28
Totals	75	36	24	99	157	391

Source: Statistics Canada, Balance of Payments Report, 3rd. quarter, 1973.

These data relate to all Canadian licensees, not just those which are owned by Canadians, but show nevertheless that approximately 40% of licensees with licence agreements allowing them to export take no advantage of the opportunity.

In spite of its weakness as an indicator of motive, the export restriction clause is of major relevance to the more general question addressed by this research, namely, is licensing a viable growth strategy for Canadian owned secondary manufacturing firms. For this reason data will be collected on the incidence of export restrictions, even though such restrictions will not be included in the licensing model in this chapter. An hypothesis suggesting that export restrictions are more likely to be in effect in continuous technology transfer agreements than in one time transfers will be tested as part of the research model.

A secondary issue which this research might help clarify is that of the frequency with which export restrictions are included in licence agreements made with Canadian firms. There are two sources of data currently available on this question. The earlier of these is the Gray Report, which presented data on 208 proposed licence agreements during the period 1965-1969.[30] Not all of these were actually concluded. As the chart below indicates, only 5% of the proposed agreements definitely did not contain export restrictions.

Figure 2-5

Export Limitations under Proposed Licensing Arrangements

(1965-1969)

	Number	Percentage
No export limitations	10	5
Use limited to Canada	121	58
Use limited to Canada and U.S.	37	18
Undetermined	40	19
Total	208	100

Source: Department of Industry, Trade and Commerce

The more recent source of data on export restrictions was the Statistics Canada report on licensing referred to in the first chapter.[31] This data is more detailed than that in the Gray Report, and refers to licence agreements in effect in 1972. The chart below indicates the frequency of export restrictions by country of control of the licensee.

The numbers revealed in Figure 2-6 are quite surprising, and do not lead to the same conclusions as those in the Gray Report. On an overall basis approximately 35% of the agreements contained no export restrictions, and 48% restricted the licensee to Canada. These figures compare to 5% and 58% in the Gray Report. For Canadian owned firms the message is even farther away from the Gray Report implications, with 63% of the agreements allowing exports to all countries, and only 24% restricting the licensee to the Canadian market.

The data collected in this research will provide more information on the incidence of export restrictions in licence agreements entered by Canadian owned manufacturing firms, and may help resolve this apparent contradiction.

Figure 2-6

Licensing Agreements Involving Canadian Firms, 1972.

Control of Licensee	Licence Agreements	Export Restrictions Allowing Market Access to All Countries	Some Countries	Canada Only
U.S.				
manufacturing	1632	580	274	687
other	359	84	36	224
U.K.				
manufacturing	232	35	41	146
other	315	10	3	302
Other non-res.				
manufacturing	149	22	10	114
other	58	28	5	23
Canada				
manufacturing	510	320	43	123
other	162	117	3	35
Total				
manufacturing	2523	957	368	1070
other	894	239	47	584
	3417	1196	415	1654

Source: Statistics Canada, Balance of Payments Report, 3rd. Quarter 1973.

(iii) Procurement Restrictions

Procurement restrictions typically specify that the licensee must purchase certain goods - raw material, components or machinery - from the licensor. This type of restriction is shown in clause 67 of the sample agreement in the appendix. These restrictions are not of primary interest to this research, but they are to the Canadian government. The Minister of the Department of Industry, Trade and Commerce, concerned by the incidence of procurement and export restriction clauses in agreements

made with Canadian firms, recently stated his intention to introduce legislation to establish a screening agency to review licensing agreements involving Canadian firms to ensure that they are "in the best interests of Canada".[32] For this reason data will be collected on the incidence of procurement restrictions, although such restrictions will not play a role in the hypotheses of this research.

The sources of data on export restrictions also provide data on procurement restrictions. While there is something of a discrepancy between the figures supplied by the two sources, it is not as major as that in the case of export restrictions. Both sources indicate that most agreements do not contain procurement restrictions. The figures supplied by Statistics Canada are presented in Figure 2-7.

Figure 2-7

Licensing Agreements Involving Canadian Firms, 1972.

Procurement Restrictions

Control of Licensee	Licence Agreements	Procurement Restrictions (no. of agrmnts.)	Mandatory Purchases ($000's)	Average Payment ($000's)
U.S.	1991	216	48240	223
U.K.	547	15	3199	213
Other non-resident	207	23	4723	205
Canada	672	23	9342	405
	3417	277	65504	

Source: Statistics Canada, Balance of Payments Report, 3rd Quarter 1973.

These data show very few procurement restrictions to be in force. What is surprising is that the average amount spent on mandatory purchases

per restricted agreement is almost twice as high for the Canadian controlled firm as any other category. This is particularly unexpected because of the speculation in chapter one that Canadian controlled firms have lower sales per licence agreement than the others. This paradox will not be resolved by this research.

7. Licensing Motivation, The Licensee - Part Three

The preceding section on the form of licensing agreements presents more data on the motivation of the licensee which will be of use in the licensing model. The acceptance by the licensee of agreements containing export and procurement restrictions cannot fairly be said to imply anything about its motives, for reasons given previously. However the firm which enters an agreement to receive technology on a continuing basis certainly seems to be operating on a different motive than that which is desirous of only a one time transfer.

In this research it will be considered that the firm which enters a licence agreement which provides a continuing transfer of technical information from licensor to licensee is doing so in order to avoid making an investment in in-house research and development capability. This point of view is supported by Crookell's observations on the practices of Canadian firms entering licensing arrangements of this type which were quoted earlier. The motives of the firm entering a one time technology transfer agreement may be many and varied. However one motive not included in this varied list is the reliance on the technology flowing from the licensor to replace the development of an in-house research and development competence. This distinction will be further developed in Chapter Four. With this background established it is appropriate to turn to the licensing model itself.

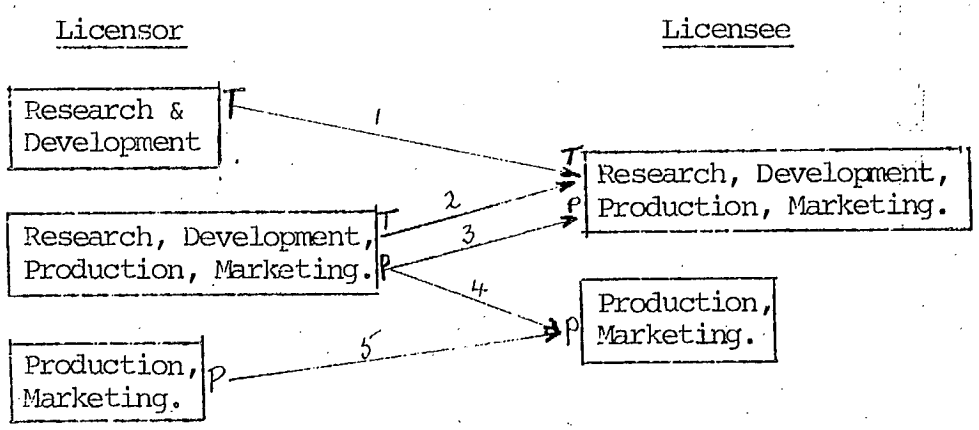
8. The Licensing Model

This model is constructed using the concepts presented in this chapter. Its purpose is to identify the participants in licensing agreements and the possible information flows between them.

The participants, clearly, are licensor and licensee. These firms will both be categorized according to the functions of which they are capable. Three categories of firm will be established. These are the "research" firm, the "complete" firm, and the "production" firm. The research firm is depicted as being a small research oriented firm or individual, or public research laboratory, all having limited production and marketing facilities. The complete firm is that with research and development capability in addition to production and marketing competences. Finally, the production firm has only production and marketing skills. Firms acting as licensors and licensees will be of all three types. However, the licensee without production facilities will, as stated earlier, be considered for the purposes of the model then, there are five possible types of participants. These are diagrammed below, together with the possible information flows between them.

Figure 2-8

The Licensing Model



T represents transfer at the "technology" level.
P represents transfer at the "producer" level.

The addition of information flows to the diagram introduces the concept of technology level as explained in the technology transfer section. Thus licensable transfer may be at either the "technology" or the "producer" level. These are labelled "P" and "T" in the diagram. Licensing between firms with full capabilities may be at either level, that involving firms lacking an R&D competence must be at the "producer" level, and that involving firms with only an R&D competence must be at the "technology" level. It should be remembered that the operational difference between these levels is that the technical information at the "producer" level is commercially proven while at the "technology" level it is not.

The five flows identified in the diagram are elaborated below:

1. This is the flow from inventor to corporation described earlier in the chapter. This inventor can be an individual, small firm, or as suggested in the technology transfer section, a public research laboratory. The identifying factors are that the licensor has no production capability and that the technology received by the licensee is not commercially proven. The demand on the licensee is that it must have the development competence to develop the technology to the point that it is commercially viable.
2. This flow is between firms of fully developed capabilities, probably both in the same industry, and involves non commercially proven technology. Given the reluctance of technology oriented firms to sell technical information outright, many of the agreements in this category would be of the cross licensing type, in which an information trade takes place.,
3. Again the flow is between fully developed firms, but this time it

involves commercially proven technology. It is suspected that the number of agreements in this category would be relatively low, as the licensor has an R&D capability and would probably prefer to develop its own new products, rather than pay the royalty rates on a commercially proven product.

4. In this case the flow is again of commercially proven technology, but the licensee does not have an R&D capability. This lack limits the firm to receiving commercially proven technology, as it does not have the resources to develop unproven technology to a proven state. The incidence of this type of licensing is expected to be quite high in Canada, since many firms are without R&D capability. All licensees whose licensing motivation is to use the licensor on a continuing basis to replace in-house R&D, as discussed in the section on the form of licensing agreements, would be included in this category of transfer.

5. Finally, this type of transfer is of commercially proven technology, between two firms neither of which have an R&D capability. In the absence of any R&D competence on the part of the licensor it is expected that the information transfer to the licensee would consist largely of technical know how, or perhaps trademarks, with a minimal number of agreements involving patents. The licensor is not in a position to generate patents. The licensor's lack of R&D competence is also expected to limit agreements in this section to <u>one time</u> transfers of technology. There will be no ongoing research effort for the licensee to tap on a continuing basis.

This model is one of the important inputs into the research model constructed in Chapter Four. It is a broader model than the

research model and thus some parts of it, as presented here, will not be tested.

9. Summary

This chapter has covered a wide range of material. The purpose has been to examine the diverse concepts which have a bearing on a study of licensing and to combine those considered to be most relevant in a licensing model. The purpose of the model is to indicate the most common licensing situations and as well some of the most important licensing variables.

In Chapter One it was stated that a major task of the research is to determine the conditions under which licensing takes place. This leads to the question of what kinds of "conditions" are to be considered. The licensing model begins to answer this question. Conditions will include for example whether or not export restrictions are included in a licence agreement, and whether or not the licensee is competent at performing research and development. Another factor which will be of great importance is the distinction between one time and continuing technology transfer introduced in this chapter.

The licensing model is only one of three major inputs to the research model. The others introduce further variables and focus the model more directly on the competitive problem faced by the Canadian owned manufacturing firms. The specific nature of this problem, which is the second significant input to the research model, is discussed in the first part of the following chapter. The second part of the chapter introduces a conceptual model by Len Wrigley which provides the final input for the research model.

Chapter Two

Footnotes

1. L.J. Eckstrom, Licensing in Foreign and Domestic Operations, (New York, Clark Broadman Company, 1974), revised 3rd. edition, p. 1-105.
2. Ibid., p. 1-107.
3. Ibid., p. 1-103.
4. See Eckstrom, Chapter One, for a list of 30 reasons why licensors license.
5. O.J. Firestone, Economic Implications of Patents, (Ottawa, University of Ottawa Press, 1971), p. 129.
6. See, for a detailed presentation, R. Vernon, Manager in the International Economy, (New Jersey, Prentice Hall, 1972), Chapter Ten.
7. W.G. Friedmann and G. Kalmanoff, Joint International Business Ventures, (New York and London, Columbia University Press, 1961) p. 152.
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12. Eckstrom, p. 1-125.
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14. W.H. Gruber and D.G. Marquis, "Research on the Human Factor in the Transfer of Technology", in Factors in the Transfer of Technology, Gruber and Marquis eds., (Cambridge, The M.I.T. Press, 1969) p. 255.

15. Ibid., p. 257 and introduction, p. 5.

16. J.A. Morton, "From Research to Technology", in The R&D Game, D. Allison, ed., (Cambridge, The M.I.T. Press, 1969) p. 213.

17. This distinction between vertical and horizontal transfer is believed to have been first made by H. Brooks in The Government of Science, (Cambridge, The M.I.T. Press, 1968).

18. Morton, p. 213.

19. H. Crookell, "The Transmission of Technology Across National Boundaries", Business Quarterly, Fall 1973.

20. R.S. Rosenbloom and F.W. Wolek, Technology and Information Transfer, (Boston, Harvard University Press, 1970), p. 52.

21. Ibid., p. 1.

22. J.E. Goldman, "Basic Research in Industry" in The R&D Game, D. Allison, ed., (Cambridge, The M.I.T. Press, 1969) p. 199.

23. S.I. Doctors, The Role of Federal Agencies in Technology Transfer, (Cambridge, The M.I.T. Press, 1969).

24. Ibid., p. 4.

25. Bourgeault, p. 17.

26. K. Mason, Standard Clauses in a Licensing Agreement, (Hampshire, Kenneth Mason Publications, 1970).

27. Ibid., p. 3.

28. Crookell, 1973, p. 56.

29. Ibid., p. 54.

30. Gray, p. 168.

31. Statistics Canada, Balance of Payments Report, (Ottawa, Statistics Canada, 1974), 3rd. quarter 1973.

32. This intention was stated by Alistair Gillespie in November, 1973, see the Globe and Mail, November 27, p. 1.

Chapter Three

This chapter consists of two parts. The first is an analysis of the competitive situation faced by the Canadian owned manufacturing firm. The second is a conceptual model dealing with the nature of integration between research and development and production facilities. Part One indicates that the root of the problem of the Canadian owned firm is its inability to operate in environments of high uncertainty. Part Two suggests that licensing is not a suitable strategy for conditions of high uncertainty. This chapter taken as a whole leads to the expectation that licensing will not solve the problems of the Canadian owned manufacturing firm.

Part One

Domestic Competition: The Dilemma of the Canadian Owned Firm

In Chapter One reference was made to researchers who have suggested that the lack of R&D by Canadian owned firms has impaired their competitive performance. In order to determine whether or not licensing can improve the position of the Canadian owned firm a more detailed analysis of the domestic competition faced by Canadian owned firms is needed. Such an analysis has been made in the Canadian appliance industry by Harold Crookell.[1] Crookell analyzed the competition in product life cycle terms, and before examining his work it is necessary to review the product life cycle concepts.

1. The Product Life Cycle

The product life cycle model went through two distinct phases and for clarity these are presented here separately. The model initially evolved as a marketing concept and was used (and still is) as a useful

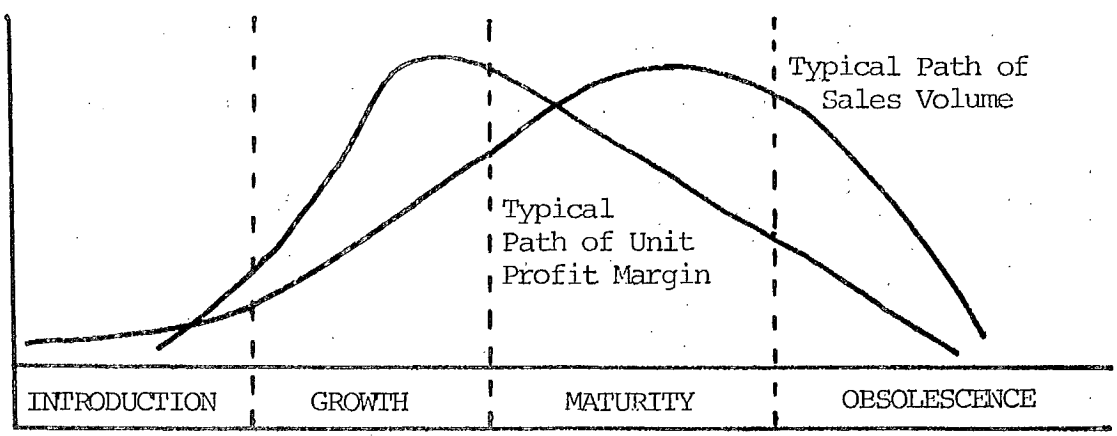
form of analysis for planning marketing strategy. This product life cycle model was modified and given a new role in the mid 1960's, when it was used to explain international trade flows. Both of these variations of the product life cycle model are relevant to this research and are explained in the following sections.

(a) The Marketing Concept

The product life cycle as typically presented in marketing texts is shown in Figure 3-1. This model hypothesizes a predictable pattern of unit profit and sales volume for a product as it matures. As can be seen from the diagram, profit margins and sales growth are postulated to be highest near the beginning of the product life cycle. There is no fixed length to the life cycle, it depends on the characteristics of the product and the speed with which competitors develop rival products. The product life cycle model has been tested empirically for 140 categories of nondurable consumer goods and found to be generally valid.[2]

Figure 3-1

The Product Life Cycle



It is not the precise shape of the sales curve which is of prime interest to this research. What is important is that there are potential rewards, in terms of profitability and/or sales growth, to the company which begins to produce early in the product life cycle. Wrigley explicitly adopts this assumption in his model presented in Part Two of this chapter.

> Competition between firms is keen in terms of speed of innovation but less so in terms of price movements, that is, a leader strategy opens the option either of a big profit or capture of a large share of the market, or both. [3]

When adapting the product life cycle model to explain international trade flows Vernon makes the same assumption, referring to the "monopoly windfall for early starters".[4]

This assumption, made throughout this analysis, leads to a key element of competition. Which firms produce at the beginning of the product life cycle? Who is it that receives the "monopoly windfall" or the option for a big profit or large market share?

(b) International Trade Flows

The marketing product life cycle was further developed in the 1960's and used as a means of explaining international trade flows in manufactured goods. Vernon is credited with providing the first complete description of this model, as it was adapted for this purpose.[5] Crookell used this model in his thesis to predict trade flows and the nature of competition between U.S. and Canadian appliance firms. Crookell's competitive analysis, which is of major importance to this research, is better understood after a review of the product life cycle model as it is used to explain international trade. Vernon's model is

explained in the following paragraphs.

Vernon's product life cycle model was first presented in 1966. It was based on the marketing product life cycle model, but introduced new variables as appropriate to its new context. The model's emphasis is on the timing of innovation, the effects of scale economies, and the role of ignorance and uncertainty in influencing trade patterns. The traditional comparative cost basis of explaining trade flows is completely abandoned.

(i) The New Product

Vernon argues that knowledge is not a universal free good and that ease of communication is a function of geographical proximity. For this reason firms located in a certain market will be aware sooner of the needs of that market than firms located elsewhere. Vernon centres his model around U.S. firms and the U.S. market. Comparing the U.S. market with others, Vernon categorized it as having consumers with a very high average income, as having high unit labour costs, and relatively unrationed capital. Based on this analysis it is postulated that firms located in the U.S. will be first aware of opportunities to satisfy new wants associated with high income levels or high unit labour costs. Vernon further assumes that "the evidence of an unfilled need and the hope of some kind of monopoly windfall for the early starter both are sufficiently strong to justify the initial investment that is usually involved in converting an abstract idea into a marketable product".[6] He indicates that the reasoning presented thus far explains why products such as the sewing machine, the typewriter, and the tractor first appeared in the U.S.

Vernon presents a second hypothesis concerning new products,

and this is that not only will products of the type described be first conceived of in the U.S., but also that they will be first produced there. His argument has nothing to do with international transport costs, tariffs, or relative labour and material costs, but rather with the uncertainty surrounding the production of new products. Vernon indicates that in early production the product may be quite unstandardized with the inputs required to make it changing, the process by which it is made fluctuating, and the product's final specifications covering a wide range. Because of this uncertainty the firm needs to be close to its customers, suppliers and even competitors. As these will be only in the U.S. in the early stages, the firm will begin production of the new product in that country.

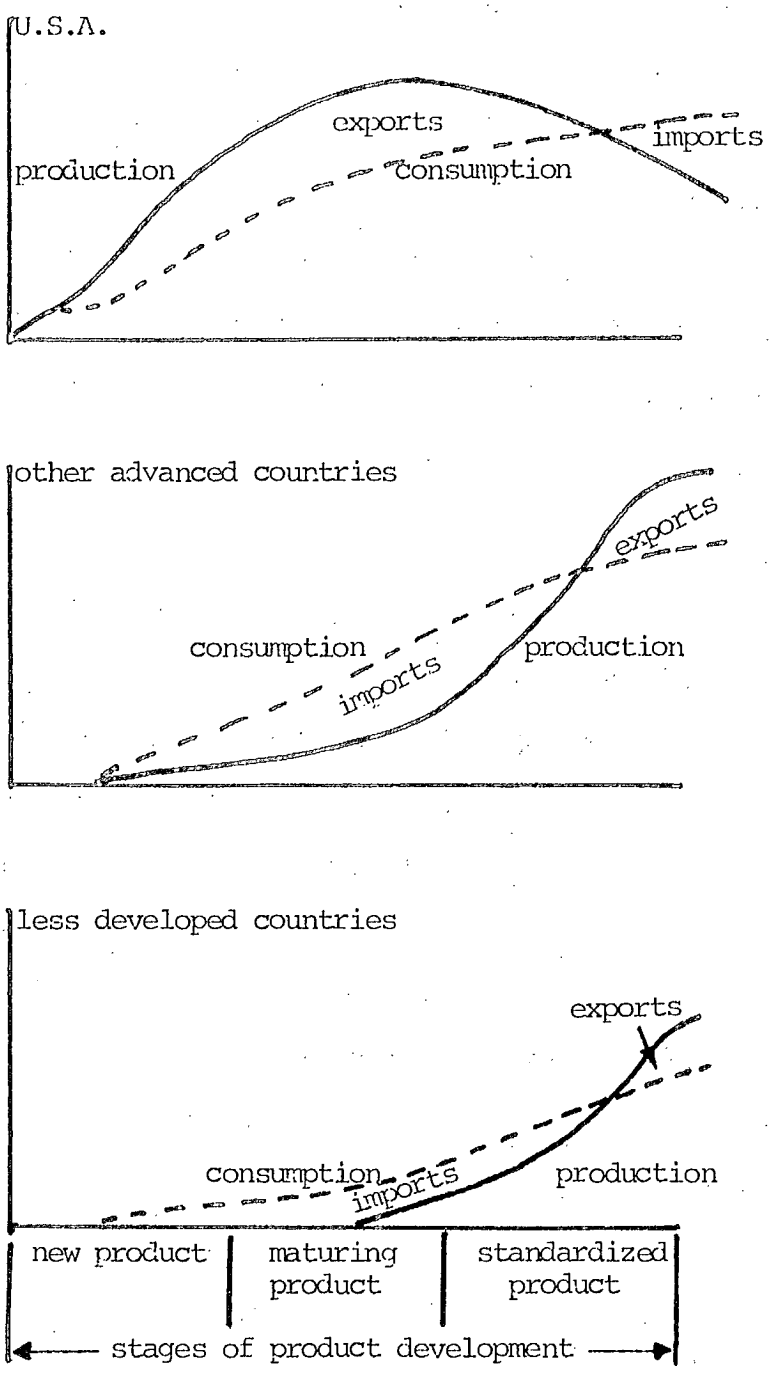
(ii) The Mature Product

Vernon argues that as demand for a product grows, the product becomes standardized. Although competitors will attempt to differentiate their products, "a growing acceptance of certain general standards seems to be typical."[7] As the product becomes standardized the need for flexibility in production declines, and long term commitments to given processes and facilities can be made in order to achieve economies of scale in the production operation. Production costs begin to take precedence over product characteristics as an area of concern.

During this stage of the cycle demand for the new product will arise in countries with markets closely similar to the U.S. market, such as Canada and Western Europe. This demand will initially be filled by exports from the U.S. production operation, but eventually it is likely that the U.S. firm will decide to begin production in the foreign country to compete with the local national firms which may begin production

Figure 3-2

The Vernon Product Life Cycle Model



Source: Vernon, R., International Investment and International Trade in the Product Life Cycle.

to replace the imports. If labour costs in the foreign subsidiaries of the U.S. firms are sufficiently below those in the U.S., and if plants in both areas are obtaining economies of scale, the subsidiary may begin shipping to third countries and exporting back to the U.S. may become a possibility. The diagram on the following page indicates the trade situation as the product matures.

(iii) The Standardized Product

In the final phase the product is highly standardized, assumed to have a well articulated easily accessible international market, and it sells primarily on the basis of price. As the following diagram shows, Vernon postulates that production in this stage may well move to less developed countries, where labour costs are lowest. This investment in the less developed countries is envisaged to be vertical integration in which all of the necessary input are provided by the parent firm, and all of the output is sold to the parent for distribution throughout the world.

2. Related Research

Seev Hirsch, a doctoral student working under Vernon's direction, prepared a very useful diagram of the hypothesized characteristics of the product life cycle model.[8] This is shown in Figure 3-3. The product life cycle model has been tested by a number of researchers including Hirsch, and has been accepted as being generally valid.

Figure 3-3

Characteristics of the Product Life Cycle

Characteristics	Cycle Phase		
	Early	Growth	Mature
Technology	Short runs. Rapidly changing techniques. Dependence on external economies.	Mass production methods gradually introduced. Variations in techniques still frequent.	Long runs and stable technology Few innovations of importance.
Capital intensity	Low.	High, due to high obsolescence rate	High, due to large quantity of specialized equipment.
Industry structure	Entry is know how determined. Numerous firms providing specialized services.	Growing number of firms. Many casualties and mergers. Growing vertical integration.	Financial resources critical for entry. Number of firms declining.
Critical human inputs	Scientific and Engineering.	Management.	Unskilled and semi-skilled labour.
Demand structure	Sellers' market. Performance and price of substitutes determine buyers' expectations	Individual producers face growing price elasticity. Intro-industry competition reduces prices. Product information.	Buyers' market. Information easily available.

Source: S. Hirsch, "The U.S. Electronics Industry in International Trade", in The Product Life Cycle and International Trade, L.T. Wells, editor.

The relationships suggested by Hirsch are very interesting. In the early stage the technology is very uncertain, and changes often. As a result, scientific and engineering personnel are critical, and little

capital investment is required. Because volumes are low it is important to be able to rely on outside suppliers for components which could not be produced at reasonable cost within the firm. This point will be mentioned again, much later in the research. As the product matures the technology stabilizes, resulting in a necessity for a large capital investment to be committed to a given technology. Technical personnel are now of less importance. Some of these concepts developed by Hirsch will be used in a later section dealing with technical uncertainty. Now that the product life cycle has been explained, Crookell's model and findings will be explained.

3. The Nature of Competition in Canada

Working from Vernon's product life cycle model Crookell developed a model of the introduction of new products to the Canadian market. Applying the principles laid down by Vernon with respect to first manufacture being in the U.S., followed by exports to other developed countries, then subsidiary manufacture overseas, Crookell created the five stage model shown in Figure 3-4.[9]

Figure 3-4

The Product Life Cycle in Canada

Stage 1	U.S. innovation successfully introduced at home.
Stage 2	Finished product exported to Canada via subsidiary company marketing systems.
Stage 3	Canadian subsidiaries assemble, then integrate production operations in Canada and gradually increase Canadian component content.
Stage 4	Canadian owned firms begin production of the new product

Stage 5 Production becomes increasingly automated over time as the product matures and the market becomes better defined. Some exporting back to innovating country.

Crookell argued that the product life cycle theory suggests that in the early stage of a product's life Canada will be a net importer from the U.S. This follows from the existence in the U.S. of a large high income market and large marketing oriented firms heavily committed to research and innovation. When imports reach a high enough level to justify it, the subsidiaries will begin to assemble in Canada, gradually moving to integrated production in Canada. Only after all this has happened will the Canadian firms start to manufacture.

Crookell verified most of his model, working from trade statistics and data supplied by appliance firms. The hypothesis of particular interest here is that concerning the proportion of production accounted for by Canadian owned firms at different stages of the product life cycle. As the five stage model would suggest, Crookell expected that Canadian owned firms would account for a higher share of the production of declining products than growing or mature products. The following passage is taken directly from Crookell's thesis.[10]

> The general hypothesis concerning Canadian ownership was that it would increase as a product matured in its life cycle. This hypothesis springs from the expectation that Canadian firms would seldom innovate and would delay their entry into product markets until the size and growth rates of those markets was known. It proved impossible to obtain accurate year-by-year estimates by product of the development of ownership patterns; this was in any event periodically disturbed by takeovers. However, the following data does show the extent of Canadian ownership of production as at 1968.

	Percentage of Total Production in Hands of Independent Canadian Producers
Growth Products (forecast unit sales growth greater than 15% per annum)	
Dishwashers	0%
Air Conditioners	n.a.
Colour Television	11
Twin-Tub Washers	0
Mature Products (forecast unit sales growth between 0-15% per annum)	
Refrigerators	17
Automatic Washers	18
Clothes Dryers	19
Ranges	36
Declining Products (forecast unit sales growth of zero or less per annum)	
Black-and-White Television	10
Freezers	67
Wringer Washers	88

These figures support Crookell's hypothesis. The question posed near the beginning of the chapter - which firms produce at the beginning of the product life cycle - has been answered, at least for one industry. The foreign ones do.

4. Technical Uncertainty

The question which must now be addressed is why Canadian owned firms operate primarily in the latter stages of the product life cycle. Crookell himself suggested that it is a problem of risk. He stated that the Canadian owned firms wanted to "avoid the risk inherent in growth products".[11]

Certainly the literature of product life cycle theory as

exemplified by Vernon and Hirsch indicates that technical un
and thus the technical risk faced by the firm, is higher in
stages of the product life cycle. Vernon emphasizes the lack
dardization of the product design in its early stages, as wel
fl
proc used to make

> ... the product itself may be quite unstandardized for a time; its inputs, its processing and its final specifications may cover a wide range. Contrast the great variety of automobiles produced and marketed before 1910 with the thoroughly standardized product of the 1930's or the variegated radio designs of the 1920's with the uniform models of the 1930's.[12]

In the chart prepared by Hirsch which is reproduced ear
in this chapter, technology in the early stage is characterized by
"rapidly changing techniques", in the growth stage by "variations
technique still frequent", and in the mature stage by "few innova
of importance". Clearly technical uncertainty is declining as the
product matures.

Although not mentioned by the product life cycle scholars
it seems reasonable to postulate as well that the level of technica
uncertainty varies from product to product, even at the same stage
the product life cycle. That is, there will likely be more technica
uncertainty in the early product life cycle stage of a video tape
recorder than at the early stage of a new type of shoe, although in
both cases this uncertainty will decline over time. This concept w
be returned to later in the research.

The question of why Canadian owned firms avoid uncertaint
will not be addressed here. As stated previously many researc

believe that the relatively small size of Canadian owned manufacturing firms restricts them from a meaningful R&D effort, and this in turn, it could be argued, precludes their operating in areas of high technical uncertainty.

Now that the central competitive disadvantage of the Canadian owned manufacturing firm has been postulated as its inability to operate in conditions of high technical uncertainty, the question must be: is the acquisition of technology via licence agreement a suitable strategy in conditions of high technical uncertainty? Can licensing solve the problem of the Canadian owned manufacturing firm?

Part Two

The Wrigley Model

Wrigley's concepts and models were not developed specifically to be applied to the licensing situation, but are certainly appropriate to a study of it. The following sections draw on Wrigley's thesis and subsequent papers to present a model relevant to the viability of the licensing option in conditions of uncertainty.

1. Core Skills, Integration, and Uncertainty

In his thesis, Divisional Autonomy and Diversification,[13] Wrigley built from the work of Donaldson Brown, Alfred Chandler, and Bruce Scott. His concern, as with all of these men, was with relationships inside the firm. However, while all were concerned with the relationship between units, (relationships between corporate headquarters and divisions, or between divisions), Wrigley focussed particularly on the key underlying variable, relationships between people. The most prominent example of this is the "core skill" which Wrigley introduced

in his thesis.

Wrigley's problem was to measure diversification in a more meaningful way than the previously used count of products according to SIC codes. He ultimately did this by considering a product's characteristics in terms of the relationships between people required for its successful production and sale. As a first step he decided to ignore a product's physical characteristics and conceptualize products into markets and technologies. Taking this process one step further he then conceptualized products in terms of the core skills required for their production and sale. Core skills were defined as:

> ... the collective knowledge, skills, habits of working together, as well as the collective experience of what the market and technology will bear, that is required in the cadre of managerial and technical personnel if the firm is to survive and grow in a competitive market. [14]

Diversification in Wrigley's terms now meant "going beyond the area within which the firm because of its existing core skills would find it relatively easy to expand as it grows; it meant to enter an area where different core skills were required." This new concept of diversification became widely accepted and became the basis of a large number of Harvard Business School theses.[15]

However, the concept of particular interest to this research is not diversification but core skills. Wrigley expanded on this concept in a later section of his thesis.

> In the use of this notion (core skills), two aspects of it may be observed. First, it refers to both a market and a technology. It is, in fact, a skill relating the two under competitive conditions. That is to say, it is not just a knowledge of the market

> or of a technology, but of one in relation to the other.
>
> Secondly, the skill is collective in character. It is not just a mere summation of individual skills. It is a skill which develops over time within a group of people who work together in relation to particular tasks and problems, appertaining to particular markets technologies. Products, therefore, may be identified and distinguished by regard to the core skill required for their production and sale. [16]

These two paragraphs are the clearest statement of core skills which exists. They will be returned to in a later analysis of Wrigley's model.

In the years since the completion of his thesis Wrigley has turned his attention fully to the process of corporate growth and development. Continuity is provided with his earlier work on core skills by way of his continued interest in the relationships between people as an important explanatory variable with respect to growth. He addresses the issue of corporate growth from the viewpoint of the producing unit (in a large firm, the division) and its needs. The question is whether these needs can best be met from inside the firm, or outside. For this research project one need is particularly relevant - the need for new technology. Wrigley has devoted considerable study to how this need can best be supplied to the producing unit and the following sections present a slightly abridged version of his model in which he compares the administrative integration of R&D with production, with market integration of the two. The model is titled, R/D and Production: Model Predicting Relationship in Various Economic States.[17]

(i) The Question

The question that arises is in terms of integrating production to R/D and the relative advantage of integration by the marketplace. Two

aspects of the question are considered: 1. What are the advantages in general? 2. Under what circumstances are the advantages greatest and least?

(ii) Assumptions

For the purpose of constructing a model predicting the relationships, and the relative advantages of one or other of these relationships, between production and R/D in various economic states, five assumptions are made, as follows:

1. All economic activity consists of three things (1) integration (2) R/D, and (3) production. These activities are undertaken by persons who specialize in one to the exclusion of the other two.
2. Integration consists of relating R/D to production.
3. Two methods of integration are open. First, the market mechanism, which includes (a) search for the relevant markets, (b) negotiations between buyer and seller and the contract of sale, and (c) settlement terms and procedures for contract performance and non-performance (in terms of specifications and time). Secondly, the administration within a firm, including the (a) structure, (b) contract of employment between employer and employee, and (c) motivation system.
4. An uncertain world, i.e. where there are unpredictable changes in demand, technology and resources, with the unpredictability becoming increasingly greater the further ahead in time.
5. Competition between firms is keen in terms of speed of innovation but less so in terms of price movements, that is, a leader strategy opens the option either of a big profit or capture of a large share of the market, or both.

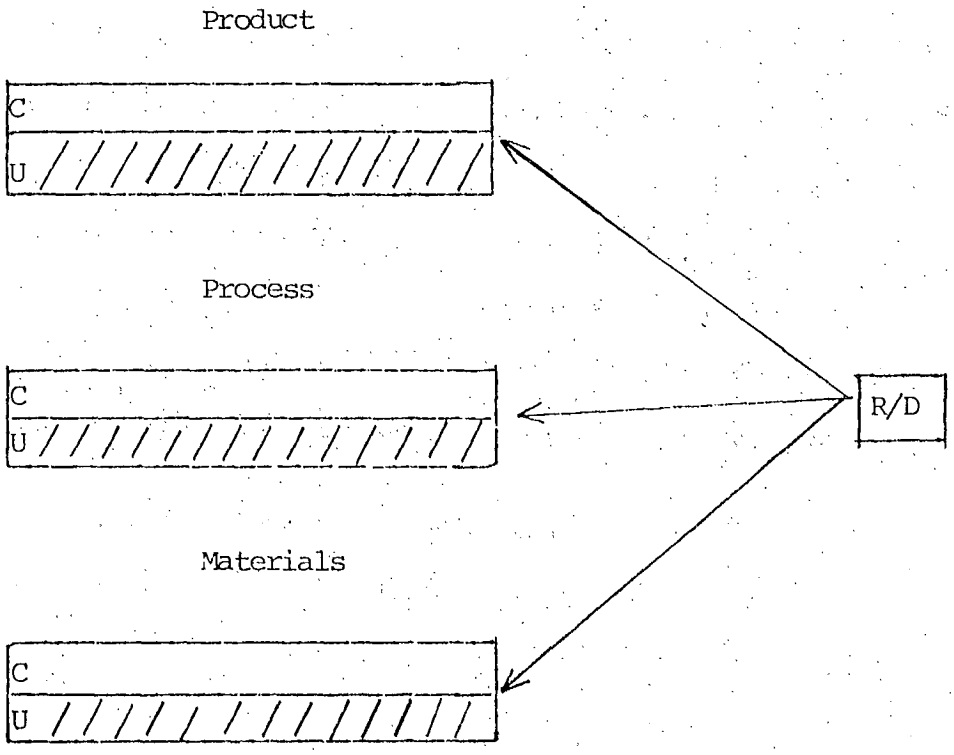
(iii) Definitions

For the purpose of the model, production and R/D are defined as below:

1. Production includes material purchases, processes, and sale or outputs. In tangible terms, it includes warehouses, plants, machine tools, and production workers, foremen and managers.
2. R/D includes all sources of innovation such as research laboratories, design teams, prototype and development units, engineering services, and in human terms, scientists, technologists, and high level engineers.

(iv) The Model

The model consists of a diagram, and a set of arguments based upon the assumptions and definitions.



C Certain World

U Uncertain World

A. Unless the output for R/D can be specified in exact terms as to technical nature and time periods, there is no basis upon which the market can integrate production to R/D. This integration has to be performed by administration. This is not just an argument that there are costs to using the market mechanism, and that these costs are higher than those for administration. The argument goes deeper than that:

1. In a contract of sale across the market, it is necessary for the product to be specified in terms sufficient to enable perception of performance and non-performance, and of the amount of damage in the event of non-performance. This requires that the buyer know what he will require in exact terms. When the future in regard to materials or processes and products cannot be predicted exactly, the buyer cannot exactly specify what he will want in the future.
2. In a contract of employment all that is necessary in the contract is the limits to what the employee is expected to do. The details can be decided later, or by the employee himself - to whom it may be a matter of indifference but who will respond to perception of corporate or colleague needs, or instructions.

Thus, the greater the uncertainty, the unpredictability of the future, the greater the tendency to relate R/D to production by administration.

B. When there is uncertainty as to the demand and supply of R/D the relation between R/D and production must enable direct and frequent face to face contact between the relevant personnel. Given the pressure on time, this means that the same people must meet. Production personnel could not afford to meet with all R/D personnel in the world who might have a solution to their problems. And R/D personnel cannot afford the

cost of search on the market for all production plants who might need their services. Thus, the greater the advantage of face to face contact between the same people in production and R/D, the greater the tendency to relate R/D to production by administration, i.e. by contracts of employment.

2. Extension of the Wrigley Model

Wrigley's model can stand alone as a clear and logically consistent statement, complete in itself. However considering it in context, as a part in the stream of Wrigley's work allows a rich interpretation and an integration with what has gone before. This researcher has studied Wrigley's work closely and the following sections are an attempt made by this researcher to integrate this model with Wrigley's previous work on core skills, and to apply the result to the licensing situation.

(i) Core Skills

It is postulated that although the phrase has not been mentioned, the Wrigley model is stating the need for a firm to have a fully developed set of core skills. A core skill was presented earlier as "a skill which develops over time within a group of people who work together in relation to particular tasks and problems, appertaining to particular markets and technologies". The same concept underlies the statement in part B of the model that"the relation between R&D and production must enable direct and frequent face to face contact between the relevant personnel".

Wrigley's definition of "production" includes the sale of outputs, thus bringing in the marketing element. The model is thus stating the need for a strong relationship between R&D, production and

marketing personnel. In short, the need for a firm to have complete core skills.

This researcher's interpretation of the model is that Wrigley is making an addition to the core skills concept, not previously explicitly stated. This is that the core skills concept includes a future dimension. In part A of the model there are several statements giving rise to this interpretation. "Unless the output for R&D can be specified in exact terms as to technical nature and time periods..." is a statement referring to future R&D output and future time periods. "When the future in regard to materials or processes and products cannot be predicted exactly, the buyer cannot exactly specify what he will want in the future" is a statement indicating clearly that the firm needs an estimate of future technology to function well in the present. The diagram below represents diagrammatically that the core skills concept includes not only a knowledge of present markets in relation to current technology, but also information and estimates of future markets and technology in relation to each other and present ones.

Figure 3-5

Relationships Included in Core Skills Concept

Empirical support of the importance of the core skills concept was published in Harold Crookell's article, The Transmission of Technology Across National Boundaries.[18] This article reported research on the technology transfer process as it takes place within the multinational

firm. One of the major determinants of efficiency of the technology transfer process was determined to be the development of "enduring relationships" between senders and receivers of technology. This relationship is clearly part of Wrigley's core skill concept. With respect to the flow of technology from the U.S. product division to the Canadian subsidiary the following statement was made.

> It was, in fact, often repeated, at both sides of the border, that very strong personal friendships had developed between Canadian engineers and their American counterparts in the product divisions which made the transfer of product technology virtually problem free. 19
> (emphasis added)

(ii) Core Skills and Licensing

The argument presented thus far suggests that the core skill concept includes a future dimension. The development of this future dimension is facilitated within the firm because of the increased opportunity for face to face contact. The necessary personal relationships can be established. People who know one another can evaluate information passed between them, and judge the reliability of forecasts, estimates, and promises. This process is also aided by the nature of employment contracts, which define only the limits of the employee's action and leave him free to respond to personal and corporate needs.

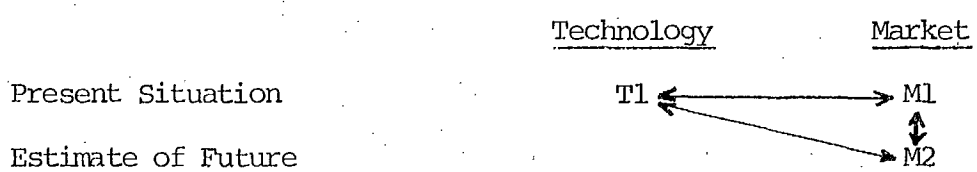
Licensing agreements, on the other hand, are a free market transaction. There is a buyer and a seller, and information changes hands for a fee. An important implicit assumption underlying Wrigley's model is that this market is "pure". That is, it is a means of exchanging goods of information for a fee, and nothing more. In sharp contrast to the firm it is not a place where enduring relationships are formed,

or where communication takes place on a continuing basis. Most importantly it is not a place where one man learns to trust another's judgment. Future related information is "soft" in that it reflects a judgment made by the sender. If the integration between receiver and sender is across the market, the receiver does not know how much to trust the information. It is, for example, highly unlikely that he would risk a large capital investment on information received in this way. This fact is reflected in one of the hypotheses to be tested in this research.

The message of the preceding paragraph is that the market is unable to transmit anything but existing technology. In short, licensees relying on the licensor for technical information will not have access to future oriented technical infonmation, and thus will have truncated core skills. This situation is represented diagrammatically below.

Figure 3-6

Truncated Core Skills Caused by Licensing



(iii) Core Skills, Licensing, and Technical Uncertainty

The core skills needed by a firm are a function of its environment. If the firm is in an industry of slow technical change where technical uncertainty is not high, the firm does not need constant face to face contact with an R&D laboratory to make valid judgments concerning future technology. In this kind of environment a firm can have core skills truncated as in Figure 3-6, without adversely affecting its

performance. In other words, licensing is hypothesized to be a viable strategy in conditions of low technical uncertainty.

In conditions of high technical uncertainty a reasonable and trusted estimate of future technology is needed and truncation such as that in Figure 3-6 is unacceptable. The firm operating in an environment of high technical uncertainty cannot rely on a licence agreement as its only source of future related technical information. The firm which attempts this will be incapable of forecasting with any confidence future technical changes in the area of the licensed technology. This perspective gives a new significance and dimension to the statement of Harold Crookell quoted in Chapter Two that Canadian licensees "had so little control over the speed and direction of the licensor's research, that they were unable to formulate integrated long range plans". The Wrigley model would extend this one step further and change "control over" to "understanding of". The Canadian licensees cannot formulate meaningful long range plans because their core skills are truncated, they do not have a reasonable estimate of future technology. Hence Wrigley's statement:

> Thus, the greater the uncertainty, the unpredictability of the future, the greater the tendency to relate R&D to production by administration.

The question posed at the end of Part One has now been answered, subject to the pure market assumption. Licensing is expected to be a non-viable strategy in conditions of high technical uncertainty.

Chapter Three

Footnotes

1. Crookell, 1970.
2. R. Polli and V. Cook, "Validity of the Product Life Cycle", Journal of Business, October 1969, p. 385.
3. See Chapter Three, fifth assumption in the Wrigley model.
4. R. Vernon, "International Investment and International Trade in The Product Cycle", Quarterly Journal of Economics, volume 80, 1966 as reproduced in International Investment, John Dunning, ed., (Middlesex, Penquin Books Ltd., 1972) p. 305.
5. Ibid.
6. Ibid., p. 308.
7. Ibid., p. 311.
8. Hirsch's diagram is based on work done in his thesis, The Location of Industry and International Competitiveness, (Oxford, The Clarendon Press, 1967).
9. Crookell, 1970, p. 61.
10. Ibid. p. 259.
11. Ibid., p. 260.
12. Vernon, p. 310.
13. L. Wrigley, Divisional Autonomy and Diversification, unpublished doctoral thesis, Harvard Business School, 1970.
14. Ibid., p. 11-10.
15. See for example the following Harvard Business School DBA dissertations D.F. Channon, Strategy and Structure of British Enterprise, (1971); G. Pooley-Dyas, Strategy and Structure of French Enterprise, (1972); C.H. Thanheiser, Strategy and Structure of German Enterprise, (1972); R.J. Pavan, Strategy and Structure of Italian Enterprise, (1972); and

R. Rumelt, Strategy, Structure and Economic Performance, (1972).

16. Wrigley, 1970, p. 111-7.

17. This is an internal University of Western Ontario Memo dated February 1974.

18. Crookell, 1973.

19. Ibid., p. 54.

Chapter Four

This chapter presents the research model, the hypotheses resulting from it, and the method used to test these hypotheses. The research model is constructed on three bases. These are the licensing model developed in Chapter Two, the definition of the problem of the Canadian owned firm as presented in Chapter Three, and the core skills concept as developed in Chapter Three.

1. The Research Model

The purpose of this model is to create categories of licensees and to generate predictions concerning differences in corporate behaviour and restrictions in licence agreements entered by the firms of each category. The predictions, stated in the form of hypotheses, are the output of the model.

(a) Assumptions

In order to construct a model to create meaningful categories of licensees, and to predict the behaviour of firms in each category, the following assumptions are made:

1. Licensees will have differing competences with respect to research and development ability.
2. Licence agreements entered by Canadian owned licensees may be uniquely classified as involving continuous or one time transfer of technology.
3. The level of technical uncertainty at the beginning of the product life cycle is not the same for all products.
4. The level of technical uncertainty surrounding a product decreases as the product matures.

5. There are potential rewards in terms of increased market share or profitability for the firm which puts a product on the market near the beginning of the product life cycle.
6. The pure market assumption: Licensor and licensee can exchange only hard information, such as technical specifications or other factual data. Information of a judgmental nature, such as that concerning future technology, may be transmitted, but cannot be received because the licensee does not know the licensor well enough to evaluate and have confidence in its judgment.

(b) Definitions

The following definitions are a necessary part of this model.

Research and Development Competence: This term refers to the general competence of the firm to develop new products and processes. An important characteristic of such a firm is that at any given time it will be working with technical ideas relating to products to be marketed several years in the future, thus allowing the firm a reasonable estimate of future technology. Research and development competence will be a relative measure, based on a firm's proportion of qualified scientists and engineers (QSE's) to total employment. The firm with a higher proportion of QSE's will be considered to have a greater research and development competence.

One Time Technology Transfer: In licence agreements involving one time technology transfer the licensor transfers to the licensee only currently known information and does not promise to inform the licensee of any new developments to be made in the future.

Continuing Technology Transfer: Licence agreements involving continuing technology transfer are those in which the licensor agrees to supply new knowledge to the licensee as it is developed in a specific technical area for a given number of years.

(c) The Model

(i) Licensee Types

The licensing model of Chapter Two identified two types of licensee, firms with research and development competence and firms without research and development competence. In this model this absolute measure is replaced by a relative one. Type One licensees will be identified as those with relatively high research and development competence and Type Two and Three as those with relatively low research and development competence. The operational difference between Type Two and Type Three licensees is the type of licence agreements they use. It is argued that the type of licence agreement, continuing or one time, used by a firm with low R&D competence, will indicate whether the firm operates in a technically innovative industry or not. This argument is developed further below.

The first position taken is that a firm with low R&D competence using a licence agreement involving a continuing transfer of technology is producing the product under licence in a technically innovative industry. A technically innovative industry is considered to be one in which technical changes are frequent and important. For this research, the critical feature of such an industry is that the technical uncertainty is high at the beginning of a product's life cycle. Technical uncertainty will be high because a new product in such an industry will breed competitors which are technically different, and it may be some time before technical

superiority is clear. Such a case was the early automobile industry.

It is argued that a licensee with a low in-house R&D competence will need a continuing flow of new technology to operate in a technically innovative industry, and will therefore use a continuing licence agreement. A second argument is that only in an industry where technological change is occurring with some regularity would a continuing licence agreement be meaningful. In a non technically innovative industry there would be no new technology to transfer on a continuing basis. Thus a licensee with low in-house R&D competence using a continuing transfer licence agreement is considered to be operating in an industry in which technical uncertainty is high at the beginning of the product life cycle. In accordance with the product life cycle model such uncertainty is expected to decrease over time.

The second position taken is that a firm with low R&D competence, using a licence agreement involving a one time transfer of technology, is producing the product under licence in a non technically innovative industry. Such an industry is one in which technical change is infrequent and not an important part of the competitive mix. As suggested in Chapter Three, in some industries, which are here being labelled non technically innovative, technical uncertainty is not high even at the beginning of the product life cycle, since competitors do not have the in house technical skills with which to develop products competing on a technical basis.

It is argued that a licensee with no research and development resources at its disposal on a continuing basis, either in-house or belonging to a licensor, could not operate in an industry in which technical change is frequent and important; and therefore, such a firm, using a one time licence agreement, must be operating in a non

technically innovative industry.

The definition of the licensee types is summarized below.

Figure 4-1

Licensee Types

Licensee	Research and Development Competence	Licensing Type
Type One	high	not specified
Type Two	low	continuous
Type Three	low	one time

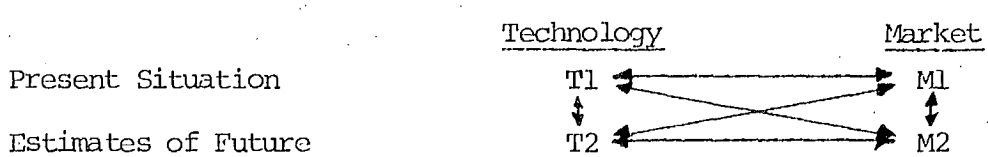
The operational definition of high and low research and development competence is given later in the chapter.

(ii) Core Skills and Uncertainty

This portion of the model draws heavily on the ideas presented in the discussion of the Wrigley model in Chapter Three. As indicated in that chapter a complete set of core skills can be diagrammed as below.

Figure 4-2

Relationships Included in Core Skills Concept



This model is concerned with the technical dimension of core skills and the marketing aspect will not be developed further here. The question must be addressed as to what T2 means to the firm in concrete terms. As suggested in the diagram T2 represents an estimate of relevant future technology. What this means is that the firm must be capable of

making confident estimates of future technology on which it can base strategic plans and investment programs. A firm with an incomplete or truncated technical core skill is one with little confidence of technological trends and implications, which consequently feels unable to formulate long range plans. Such were the firms identified by Crookell referred to in Chapter Two.

The skills needed by a firm to make a confident estimate of future technology vary with its environment. A firm operating in an environment of little technical change and low technical uncertainty does not need an in-house research and development competence to forecast future technical change. The future will be much like the past. The same is not true for firms operating in environments of changing technology, where technical uncertainty is high. These statements are expanded in the following paragraphs, which consider the completeness of the technical core skills of the three licensee types.

The Type One licensee, with relatively high research and development competence, will have a relatively confident estimate of future technology. Such a firm is considered to have complete core skills in the technical dimension.

The Type Two licensee, with a low research and development competence, argued to be operating in a technically innovative industry, will have incomplete core skills in the technical dimension. The basis for this statement is that the licensee will not be able to receive T2, an estimate of future relevant technology, from the licensor; nor will it, because of its lack of in-house skills, be able to develop such an estimate for itself. It is the pure market assumption which states that the licensee will not be able to receive estimates of future technology

across the market (i.e. from the licensor). The necessary interpersonal relationship is lacking. The licensee does not know how to evaluate soft or judgmental information received from the licensee. Thus the Type Two licensee has no indication of future technology, and has incomplete technical core skills.

The Type Three licensee also has a low in-house research and development competence, but is argued to be operating in a non technically innovative industry. In such an industry a research and development competence is not necessary for confident estimates of future technology. As stated earlier, the future will be much like the past. In this case it is not necessary for estimates of future technology to pass from licensor to licensee. The Type Three licensee has complete technical core skills.

Figure 4-3

Licensee Types - Core Skills

Licensee	Research and Development Competence	Technically Innovative Industry	Technical Core Skills
Type One	high	yes	complete
Type Two	low	yes	incomplete
Type Three	low	no	complete

(d) Hypotheses

The hypotheses are based primarily on the completeness of the licensee's core skills.

Type One Licensee

This category of licensee has a relatively high proportion of qualified scientists and engineers to total employment in the area of

technology relevant to the licence agreement. In many cases the licence agreement will be a matter of convenience, as when it is cheaper to license permission to use a patent than design around it. The key to creating hypotheses for this category of licensee is to disregard the licence agreement and concentrate on the firm's other characteristics. This firm has complete technical core skills. It will not avoid operating in areas of high technical uncertainty. It is anticipated that such firms will endeavour to operate at the beginning of the product life cycle, just as would any other firm with research and development competence, whether involved in a licensing agreement or not.

Since the firm is technically competent in the area of technology covered by the licence agreement, there is no reason to expect it to avoid making investments in this area. It is argued that the investments made by firms in this category relating to products produced under licence will generally be higher than those made by licensees with incomplete technical core skills.

Type Two Licensee

This category of licensee has relatively low research and development competence and is attempting to get the future oriented technical information it needs via a continuing transfer licensing agreement. Given the pure market assumption, this will not be possible. The firm now faces a dilemma. It has been argued that it operates in a technically innovative industry, which means that the technical uncertainty at the beginning of the product life cycle is high; yet it does not have the technical core skills to operate in an environment of high technical uncertainty. Such are the Canadian-owned firms of the Canadian appliance industry as identified by Crookell. The only solution for the

firms, which must operate in an area of low technical uncertainty, is to restrict operations to the later stages of the product life cycle. In this way the firms can survive in an environment for which they are not suited. They are, however, greatly restricted in their strategies, which cannot involve competing on the basis of new product introduction.

Firms in this category will not begin production of products under licence which involve a large initial investment. This is again a result of having incomplete technical core skills. The firms simply lack the technical confidence to make a major investment. This is the confidence referred to earlier in section (c) of the model.

A final hypothesis, only tangentially related to core skills, is that a higher proportion of the licence agreements entered by this type of licensee will contain export restrictions than those of firms involved in agreements involving a one time transfer of technology. The rationale for this argument, which was suggested in an article by Harold Crookell,[1] is that in a continuing licence agreement the licensor is repeatedly giving away its latest and most critical technology. It cannot afford to have the licensee competing against it in its home or export markets. For this reason the licensor will only enter such an agreement if the licensee is restricted to the domestic market.

Type Three Licensee

The Type Three licensee has a relatively low research and development competence and thus will operate only in areas of low technical uncertainty, but is argued to belong to a non technically innovative industry where this is the norm. In such an industry the technical uncertainty associated with new products will not be high. The counter example given in Chapter Three was the video tape recorder, a new product

introduced in a highly competitive and technically innovative industry, which immediately spawned competitive equipment based on slightly different technology. These products will compete on price and technical merit until one or two designs are accepted as standard. In an industry of low technical change this kind of rivalry and the resulting uncertainty is unlikely, leading to the assumption that technical uncertainty will not be high at the beginning of the product life cycle, leaving the Type Three licensee free to operate there if it wishes. As in the case of the Type One licensee there is a congruency between the technical competence of these firms and the demands of the environment in which they operate, and as a result they are willing to invest heavily in products or processes being introduced under licence.

A final observation may be made concerning the motives of these three types of licensees. It is only the second type that is trying to use licensing to obtain a continuing stream of new technology. Types One and Three are using licensing as a convenience, as an adjunct to their normal operations. Type Two licensees, however, critically depend on the flow of technology from the licensor for survival in the area of technology of the licensed product or process. It is, of course, Type Two licensees which are of particular interest to this research. These are the firms that are licensing <u>instead</u> of doing in-house research and development.

The chart below shows in summary form the hypotheses to be tested in this research.

Figure 4-4

Summary of Hypotheses

Licensee Type	Technical Uncertainty*	Size of Investment*	Stage of Life Cycle**	Export Restrictions***
One	1	1	1	-
Two	2	2	2	1
Three	2	1	1	2

* rank order, 1 = highest

** rank order, 1 = earliest

*** rank order, 1 = highest percentage of restrictions

Hypotheses

In this section the hypotheses just given in summary form are presented more formally.

Hypothesis One

Licensees with a high proportion of qualified scientists and engineers in their employ will begin operation under licence in environments of higher technical uncertainty than firms with a low proportion of such personnel.

Hypothesis Two

Licensees with complete core skills will make a larger initial capital investment than those with incomplete core skills to produce a product or install a process, the technology for which was obtained under licence.

Hypothesis Three

Firms with complete core skills will operate earlier in the product life cycle than those with incomplete core skills.

Hypothesis Four

Firms with licence agreements involving continuous technology transfer will more often face export restrictions than will be the case for firms with agreements involving a one time transfer of technology.

2. Research Method

Now that the hypotheses have been presented the method used to test their validity will be given. One of the most difficult tasks was to determine which firms in Canada are in fact licensees. This problem is explained further in the following section.

(a) Sample

The objective was to obtain a representative sample of Canadian owned firms which were currently manufacturing under licence. There is, however, no publically available data to indicate which firms in Canada are operating as licensees. The only data even suggesting the size of the population is that presented in Chapter One indicating that 54 Canadian owned manufacturing firms were in 1972 involved in 462 licence agreements. Considering that these 54 were the result of questionnaires sent to over 6,000 firms, probably half of which were Canadian, it seemed a desperate project to randomly approach Canadian owned firms to discover the identity of the 54. To make matters worse it was decided to limit the research to firms of the secondary manufacturing sector (definition and reasons for this are given below) and to include only licence agreements which were product related. That is, if a licence were for a very general process which did not relate to any specific end product, it would not be included. This was because such a licence could not be evaluated in product life cycle terms. These two restrictions undoubtedly reduced the population considerably from 54 firms and

462 licence agreements.

In spite of the seeming impossibility of finding many of these licensees, it was decided to approach the 50 largest Canadian owned secondary manufacturing firms, to discover if they were producing products under licence. This sample was chosen on the reasoning that if the largest Canadian owned firms were not licensing, the subject was not worth pursuing further. As it turned out, a surprising 21 licensees using 62 product related licences were contained in this group. At least 40 minor licences relating to process improvements were also encountered in the study, although data was not collected for them. These findings cast some doubt on the accuracy of the Statistics Canada figures, which in retrospect seem much too low.

A Canadian Owned Firm: A Canadian owned firm will be taken to be one whose voting shares are more than 50% owned by Canadians.

A Secondary Manufacturing Firm: Statistics Canada has established three sectors of Canadian industry: primary, primary manufacturing, and secondary manufacturing. Primary industries are fishing, forestry, agriculture and mining. Firms in industries in which at least 50% of the total value of material inputs is from the primary sector are designated primary manufacturing firms. These would be firms in such industries as food, beverages, paper and primary metals, for example. Firms in manufacturing industries obtaining less than 50% of the total value of material inputs from the primary sector are designated secondary manufacturing firms. These would include such industries as machinery, electrical equipment, and transportation equipment, to name a few. Statistics Canada has prepared a list of industries by sector which was

used for this research.

Problems still arose in the case of diversified firms which are in both the primary and secondary sectors. In these cases if a division is in the secondary sector and big enough on its own to rank in the largest 50, and the data were available for it, it was included. In the case of vertically integrated firms, spanning both primary and secondary sectors, inclusion in the sample was not made because arm's length figures between divisions were assumed unavailable. If there was real doubt as to a firm or division's correct classification, it was not included in the sample.

This research is limited to the secondary manufacturing sector because previous research, done by Bruce Wilkinson on the determinants of Canadian exports, suggests that the role played by new technology is greater in secondary manufacturing industries than in primary ones.[2] He discovered that the R&D effort was not a factor in determining the exports of primary manufacturing firms, but was a significant determinant of the exports of firms in the secondary manufacturing sector. That is, secondary manufacturing firms with a greater R&D effort exported a higher percentage of their sales; this was not true of firms in the primary sector. Although exports are only one part of a firm's business, this researcher feels that Wilkinson's findings can be generalized to the extent of saying that access to new technology is generally more important to firms of the secondary manufacturing sector than those of the primary manufacturing sector. Thus licensing, a source of new technology, is more important to firms of the secondary manufacturing sector than those of the primary manufacturing sector.

Largest Firms: The ranking by size is based on 1973 sales figures wherever these were available. In cases where they were not 1972 figures were used. A list of the 50 firms, their sales volume and major products, is contained in the Appendix Two of this chapter.

(b) Operational Definitions

Operational definitions of licensing, and the criteria for sample selection have already been specified. In other areas such as technical uncertainty, the respondent is given a choice of low, medium or high. The actual judgment of technical uncertainty level is a subjective one made by the respondent. This may lead to a certain incomparability between the responses of different firms if what one manager considers "high" technical uncertainty another would consider "medium" and so on. There is little that can be done about this as it is the respondent that has experienced the uncertainty, not the researcher, and there is no absolute scale for measuring uncertainty. However, the possible distortion caused is expected to be minimal since it is believed that any bias in response will occur randomly and not destroy the validity of the data.

One variable which needs to be made operational is the stage of the product life cycle at which a firm begins production under licence. This is a complex area as few products actually go through a regular well defined cycle as presented in the marketing texts. This is especially true if the products involved are not consumer goods and if they are in fact custom produced rather than being a standard product. For these reasons, combined with a problem of data availability, an early attempt in this research to plot the life cycle of each product being manufactured under licence has been abandoned.

It was Crookell's thesis which described the plight of the Canadian owned firm in product life cycle terms, and it seemed a reasonable place to return for assistance in operationalization of the product life cycle stages. An examination of Crookell's stages model of the product life cycle in Canada, shown in Figure 3-4, in conjunction with the quote presented earlier, "For most products, Canadian independents, because of their lateness of entry and resultant small initial market share, tended to have higher production costs and lower factory prices than U.S. subsidiaries" (emphasis added), leads to the conclusion that the key to being in the growth portion of the product life cycle is to begin production and offer the product for sale not later than the foreign competition.

As Crookell's model indicates, "late" in the product life cycle for Canadian owned firms means beginning production (Stage Four), after the foreign subsidiaries have offered the product for sale (Stage Two) and begun to produce in Canada (Stage Three). In operational terms, the comparison which will be made in this research is between the date of first production by the licensee (which in nearly all cases coincides closely with the date the product is offered for sale) and the date the product is introduced by its competition. If the date of production by the Canadian owned firm is earlier than or within a year of the market introduction by the earliest competitor, the licensee will be considered to be operating in the "early" stage of the product life cycle. If not, it will be considered to be in the "later" stage. The distinction in the literature between the mature and decline stages will not be observed, these are combined into the "later" stage. The important distinction for this research is whether the licensee begins

production (and thus offers the product for sale) about the same time as the competition or a considerable time afterward.

(c) Data Analysis and Availability

The hypothesis tests are presented in Part Two of Chapter Five, the basic unit of analysis being the licence agreement. When the licensing is being done by a division or subsidiary of a firm its own research competence, rather than that of the firm as a whole is used to determine the licensee type, except in cases where the firm has a central research and development department.

All firms were not willing or able to respond to all questions. For this reason the number of responses varies according to the hypothesis being tested. Of major importance is the fact that six of the 62 licence agreements were technical assistance agreements which covered more than one product and could not be used in the hypothesis tests of this chapter. The nature and importance of these agreements is fully described in Chapter Six.

A second factor limiting data availability was that three of the Type One agreements were for components, rather than the finished products sold by the licensees. Data are not available for these agreements concerning initial capital investment magnitudes or product life cycle stage. Other variations in data are random, and the result of certain companies not responding to certain questions.

The full sample includes 16 Type One agreements, 34 Type Two agreements, and 12 Type Three agreements. The technical assistance agreements are all Type Two, leaving a maximum data base for hypothesis tests in Chapter Five of 16 Type One, 28 Type Two and 12 Type Three agreements, for a total of 56 agreements.

Statistical tests are used wherever there is sufficient data. Background information on the tests is provided in the appendices to Chapters Five and Six.

(d) Questionnaire

Data from the 21 licensees concerning the 62 licence agreements was collected using the questionnaire reproduced at the end of the chapter. An interview was held by this researcher in each licensing division of each firm with as highly placed an executive as possible in order to collect the data outlined on the questionnaire. Data beyond the scope of the questionnaire were collected when they were offered and relevant. The data collected during these structured interviews were used to test the hypotheses and to form the basis for the conclusions of this thesis.

The questionnaire used in the research is reproduced on the following pages. More data were collected than needed to test the hypotheses, and much of this extra data are used in the descriptive analysis presented in Chapter Six.

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Footnotes

1. Crookell, 1973, p. 57.
2. B.W. Wilkinson, Canada's International Trade: An Analysis of Recent Trends and Patterns, (Montreal, Private Planning Association of Canada, no date).

Chapter Four

Appendix One

Questionnaire

COMPANY INFORMATION

The questions below are of a general nature and refer to the firm as a whole, and all of its licensing agreements.

1. Please identify the major markets in which you compete (i.e. product lines comprising over 10% of total sales) and indicate, if possible, the average annual growth rate of these markets over the past five years, and the technology level required to compete.

		Technology Level		
		Low	Med.	High
1.	(%)	___	___	___
2.	(%)	___	___	___
3.	(%)	___	___	___

2. Who are your major competitors in these markets?

   1.
   2.
   3.

3. On what basis do you compete in these markets?

1.	As buyer-seller ___	As assembler ___	As integrated producer ___
2.	As buyer-seller ___	As assembler ___	As integrated producer ___
3.	As buyer-seller ___	As assembler ___	As integrated producer ___

4. In general, how do you view yourselves in relation to your major competitors along the following dimensions?

1. Pricing policy:	lower than competitors	same	higher than competitors
2. Price leadership:	follow our competitors	equal	lead our competitors
3. Technology:	ahead of our competitors	equal	behind our competitors
4. Product design:	original and ahead of our competitors	similar	behind our competitors

5. In markets where you are an integrated producer, how have you obtained and developed the technology required to compete?

	Market 1	Market 2	Market 3
Under license including future developments			
Under license but updated in-house			
In-house product development with our resources			
In-house product development with federal help			
In-house basic research			

6. Is your company divisionalized according to the major markets in which it competes? If so, please indicate for 1973 the percent of sales and percent of profits in each major division.

Division 1	Percent of total sales	%:
	Percent of total profits	%:
Division 2	Percent of total sales	%:
	Percent of total profits	%:
Division 3	Percent of total sales	%:
	Percent of total profits	%:

7. Are your chief executives Canadian citizens?

Chief executive officer
2nd in command
Personnel manager

8. Indicate the percentage of your firm's sales manufactured under license in the following years:

1969 _____ 1970 _____ 1971 _____ 1972 _____ 1973 _____

9. Generally speaking, would you consider your firm's licensing operations to be: successful _____, or unsuccessful _____.

10. What percentage of the firm's current employees are qualified scientists and engineers?

_____

11. Does the firm belong to an industry association? If so, please specify.

_____

_____

RELATIONSHIP WITH LICENSOR

1. Name and location (city and country) of licensor.

_____

_____

2. Date of first license made with this licensor. _____

3. Approximately how many man days were spent in the last 12 months by your firm's employees visiting the licensor or vice versa?

_____

4. Indicate which of the following most accurately describes the frequency of written or verbal (telephone) communication between your firm and the licensor:

Daily _____ Weekly _____ Monthly _____ Yearly _____ Less than Yearly _____

5. At what level within your firm does most contact with the licensor take place?

Production Supervision _____ Engineering _____ Other _____ (please specify)

6. Indicate which of the following most accurately portrays your firm's relationship with the licensor:

Strength and Nature of Bond (check one)

(a) Close - personal friendships exist between our firm's personnel and that of the licensor _____

(b) Moderate - no personal friendships but efficient working relationship _____

(c) Distant - the firms are seldom in contact _____

(d) Unfriendly - the personnel of the two firms know each other but are not on amicable terms _____

Content and Form of Information Received (check one)

The licensor supplies the information we need in a form useful to us: always true _____ usually true _____ true 50% of the time _____ seldom true _____ never true _____

Timing of Information Received (check one)

The licensor supplies information when we need it: always true _____ usually true _____ true 50% of the time _____ seldom true _____ never true _____

DETAILS OF LICENSE AGREEMENT

One copy of this and the following page should be completed for each license agreement involving a transfer of know how, under which the firm is currently manufacturing.

1. Name of licensor _____

2. When did production begin under this license? _____

3. Has the royalty rate changed during the life of the agreement?

_____

4. Does the license agreement give your firm

know how only _____

know how plus the right to infringe a patent _____

5. Does the license agreement give your firm access to relevant future technology developed by the licensor? _____

6. Does the license agreement contain

export restrictions _____, procurement restrictions _____,

other restrictions
(please specify) _____

7. Approximately how much capital investment was necessitated by the decision to begin production under this license? _____

Market

If the license agreement refers to a process, please complete this section with reference to the product produced by that process.

8. Who are currently your firm's three or four major competitors in the Canadian market for this product?

_____

_____

9. If possible, specify any new firms which you feel may become major competitors within the next five years.

_____

_____

10. When was the product first introduced on the licensor's home market?

_____

11. Please complete the following table, entering on the first row data for the product the year it was first sold in Canada. On the lines below enter data for each year up to 1974, and then please enter your estimates for 1976 and 1978.

			Approximate Market Share Held By			
Year	Total Canadian Market (units)	Your Firm's Sales (units)	Imports	Foreign Subsidiaries in Canada	Canadian Licensees	Other Canadian Firms
19						
19						
19						
19						
19						
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19						
19						
19						

12. During the time your firm has been producing this product under license, its profits margin has been:

increasing _____, decreasing _____, remaining about the same ____.

13. The profit margin is higher _____, lower _____, about the same ____ than the average of products not manufactured under license.

14. During the time your firm has been producing this product under license, production difficulties associated with it have decreased _____, increased _____, remained about the same _____.

15. The production problems associated with this product are greater _____, less _____, about the same _____, as those of products not manufactured under license.

16. The product has _____, has not _____, been modified from the original design provided by the licensor.

17. The rate of duty charged on imports of this product into Canada is _____%.

18. When production began under this licence agreement the technical uncertainty was low _____, medium _____, high _____.

The marketing uncertainty was low _____, medium _____, high _____.

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Appendix Two

Largest 50 Canadian Public Owned Secondary Manufacturing Firms or Divisions.

Company	Head Office	1973 Sales Volume ($ million)	Products
ATCO INDUSTRIES LTD.	Calgary	74.8	Mobile homes and construction
AUTOMOTIVE HARDWARE LIMITED	Toronto	24.5	Nuts, bolts, fasteners
BARBER-ELLIS OF CANADA, LTD.	Toronto	49.8	Envelopes, stationery
BOMBARDIER LTD.	Valcourt, Quebec	150.8	Snowmobiles and all terrain vehicles
BRIDGE AND TANK CO.	Hamilton	20.3	Fabrication of machinery and steel products
CAE INDUSTRIES LTD.	Montreal	62.8	Electronics, aviation equipment
CDN CORPORATE MANAGEMENT	Toronto	167.2	Electrical and electronics, metallized and chemical products
CANRON LTD.	Montreal	223.9	Heavy machinery, electric motors, concrete & plastic pipe, structural steel
J.D. CARRIER SHOE CO. LTD.	Toronto	23.7	Shoes

Company	Head Office	1973 Sales Volume ($ million)	Products
COMBINED ENGINEERED PRODUCTS	Toronto	25.5	Autoparts, gears, snowplows
CONN CHEMICAL	Toronto	38.3	Aerosol packaging
CONSUMER'S GLASS	Toronto	74.5	Glass & plastic articles
COOPER OF CANADA	Toronto	32.7	Sporting goods and luggage
R.L. CRAIN	Ottawa	27.8	Business forms
DOMCO LTD.	Montreal	26.7	Vinyl floor covering and carpets
DOMINION BRIDGE COMPANY LIMITED	Lachine	278.4	Heavy steel fabrication, machinery, boilers
DOMINION GLASS	Montreal	100.8	Glass and plastic containers
ELECTROHOME LTD.	Kitchener	107.1	TV, phonographs, radio, furniture
GLENDALE CORP.	Strathroy	38.9	Mobile homes
GREAT WEST STEEL	Vancouver	46.9	Structural steel, heavy exchangers, wall systems
GREB INDUSTRIES	Kitchener	36.4	Footwear
GSW LTD.	Toronto	119.9	Housewares, appliances, building products

Company	Head Office	1973 Sales Volume ($ million)	Products
G & H STEEL	Toronto	44.3	Wire products
HARDING CARPETS	Brantford	47.7	Rugs and carpets
INTERMETCO	Hamilton	47.0	Metals recycling, steel pipe
INTERPROVINCIAL STEEL AND PIPE	Regina	75.0	Steel pipe
I.T.L. INDUSTRIES	Windsor	25.0	Steel moulds, plastic products
IVACO INDUSTRIES	Marieville	90.1	Wire, wire fabric nuts, bolts
KEEPRITE PRODUCTS	Brantford	31.5	Air-conditioning and heating
JOHN LABATT LTD.	London	402.6	Brewing, food
LEIGH INSTRUMENTS LTD.	Ottawa	30.5	Electronic equipment
LEVY INDUSTRIES LTD.	Toronto	47.7	Automotive equipment, aircraft equipment, sporting goods
MASSEY FERGUSON	Toronto	1506.2	Farm equipment, construction equipment
MAGNA INTERNATIONAL INC.		23.8	Automotive parts, agricultural equipment parts, electronic components

Company	Head Office	1973 Sales Volume ($ million)	Products
MOLSON'S COMPANIES LTD.	Montreal	522.2	Brewing, office and home furniture, industrial products
MOORE CORPORATION	Toronto	587.1	Printed forms
NEONEX INT'L LTD.	Vancouver	208.7	Mobile homes, recreational products, consumer goods
NORTHERN ELECTRIC CO. LTD.	Montreal	612.8	Communication equipment
PEERLESS RUG LTD.	Montreal	34.2	Nylon carpeting
Q.S.P. LTD.	Lachine	43.6	Fabricates structural steel
ROBERT MITCHELL CO. LTD.	Montreal	23.4	Precision sheet metal products, railway fittings
ROLLAND PAPER CO.	Montreal	46.4	High quality paper
SCOTT LASALLE LTD.	Montreal	55.4	Clothing
SKLAR MANUFACTURING LTD.	Whitby	38.1	Wood furniture
SOMERVILLE INDUSTRIES	London	51.2	Printed containers, games
TOROMONT INDUSTRIAL	Toronto	40.5	Wide range of engineered products

Company	Head Office	1973 Sales Volume ($ million)	Products
UNIVERSAL SECTIONS LTD.	Markham, Ont.	23.9	Sectional homes
VERSATILE MAN. LTD.	Winnipeg	38.0	Farm equipment
WAJAX LTD.	Montreal	62.4	Forest fire equipment and hydraulic ariel devices
WESTEEL ROSCO	Winnipeg	92.2	Steel products for farms, industrial equipment

Chapter Five

This chapter consists of two parts. The first presents numerical data designed to supplement that presently available from sources such as Statistics Canada and the Gray Report, as contained in Chapters One and Two. The second part of the chapter presents data and statistical tests to test the hypotheses of Chapter Four.

Part One

Descriptive Statistics

1. The Sample

Using criteria specified in Chapter Four fifty large Canadian owned public secondary manufacturing firms were contacted to discover whether or not they were acting as licensees in product related licence agreements. These fifty firms had total sales in 1973 of approximately six billion dollars. Unfortunately aggregate statistics for all Canadian owned firms are not yet available for 1973, so it was not possible to determine accurately what percentage of the sales of all Canadian owned secondary manufacturing firms were accounted for by those in the sample. In order to get an estimate, the 1971 sales figures of the firms were totalled and compared with the 1971 total sales of all Canadian owned secondary manufacturing firms, the most recent year for which such data is available. The sales of the fifty firms totalled just over five billion dollars, while the sales of all Canadian owned secondary manufacturing firms was calculated at approximately 7.5 billion dollars, suggesting that the sample accounts for roughly two-thirds (by sales) of the population it is representing.[1]

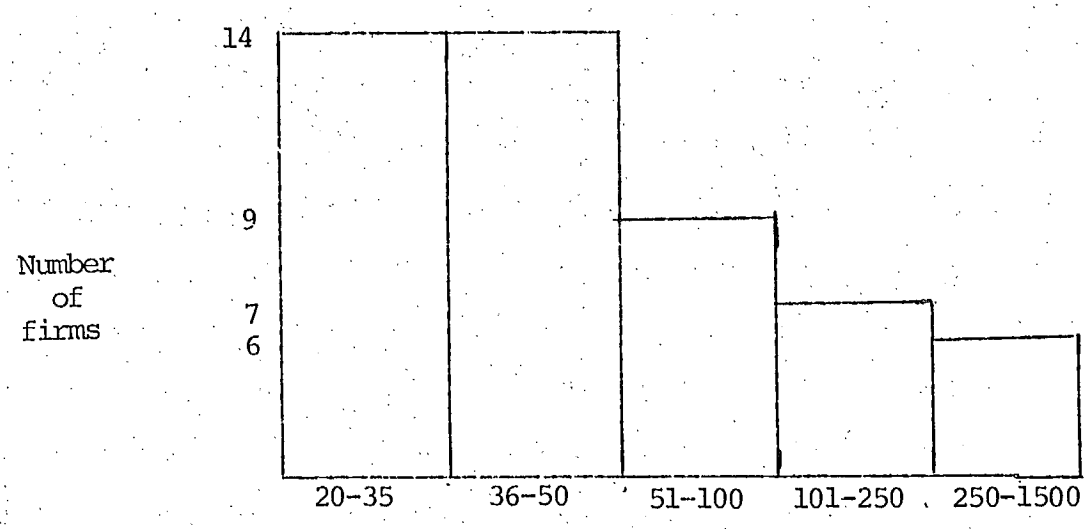
The sample is clearly not a random one. The characteristics of the licensees identified cannot be said to be representative of the

population of all Canadian owned secondary manufacturing licensees. This will be especially true in matters relating to size of firm. What will be assumed here, and more will be said on this in the second part of the chapter, is that the characteristics of the licences are representative of the total population of all licence agreements entered by Canadian owned manufacturing firms. For example, to say that the average sales volume of licensees in the sample was $119 million in 1973 is to suggest nothing with respect to the average sales volume of all Canadian owned licensees that are secondary manufacturing firms. On the other hand, the fact that very few of the licence agreements involved procurement restrictions will be considered as representative of the population, because such a characteristic is not expected to be biased by firm size.

The 1973 sales of the fifty firms ranged from $20 million to $1.5 billion. The distribution of the sales volumes of the firms is given below.

Figure 5-1

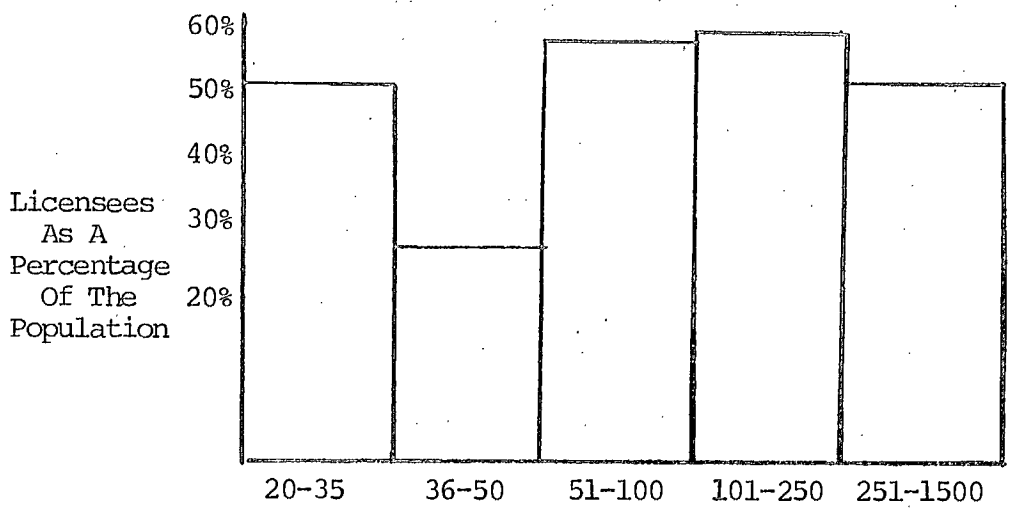
1973 Sales Distribution - 50 Firms



Of these fifty firms one declined to indicate whether or not it was licensing, 26 firms stated that they were not acting as licensees, and 23 firms indicated that they were receiving product related technology under licence agreement. The average sales volume of the licensees identified was $119 million; of the non licensees, $127 million. The distribution of licensees by sales volume, as a percentage of the total population, is given below.

Figure 5-2

1973 Sales Distribution of Licensees as Percentage of Total Population



This chart indicates that licensees are distributed in approximately the same manner as the non licensees in the population of fifty firms. That is, approximately the same proportion of firms with sales over $250 million are licensing as are firms with sales between $20 and $35 million. Manufacturing under licence appears to be a strategy employed equally frequently by large Canadian owned firms as by medium sized ones.

Of the 23 firms which identified themselves as licensees, 2

declined to take part in the research, leaving a working sample of 21 firms acquiring technology under licence. These firms supplied data on 62 licence agreements involving product related technology. The actual number of separate "productive units", that is, small firms or divisions of large firms, involved in licensing was 37. A measure of research and development competence was obtained for each productive unit.

The 37 productive units were categorized into the three licensee types, in accordance with the operational definition given in Chapter Four. Each productive unit was classified according to its research and development competence and the type of licences used. Figure 5-3 shows the categorization of the productive units and the number of licence agreements held by those of each licensee type.

Figure 5-3

Productive Units and Licences, by Licensee Type

Licensee Type	Number of Productive Units	Number of Licences Held
One	11	16
Two	18	34
Three	8	12
Total	37	62

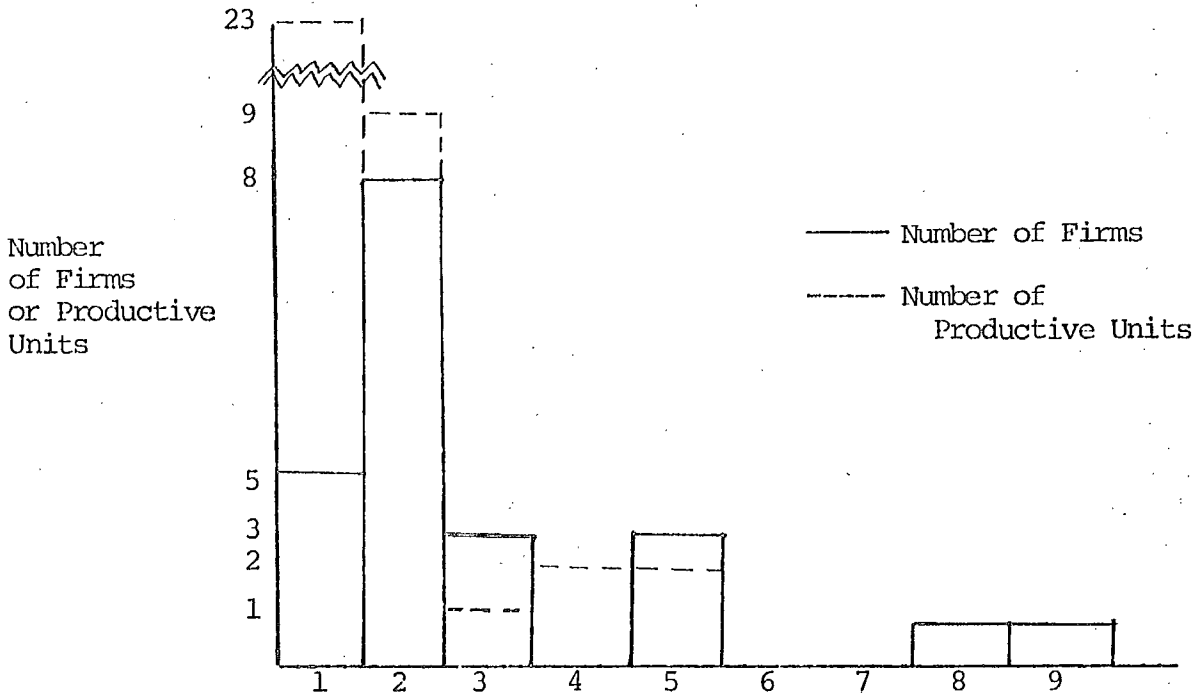
In one of the 37 cases the productive unit could have been classed as either Type Two or Type Three, as it used both continuing and one time agreements. For convenience of exposition it was included in the Type Two category in the above chart. For purposes of hypothesis testing, the continuing agreement will be classed as being held by a Type Two licensee, the one time agreement by a Type Three licensee.

2. Sales Made Under Licence

As indicated previously, the 21 firms were involved in 62 licence agreements, an average of almost 3 agreements per firm. The distribution of agreements by firm and by productive unit is shown below.

Figure 5-4

Licence Agreements per Firm and per Productive Unit



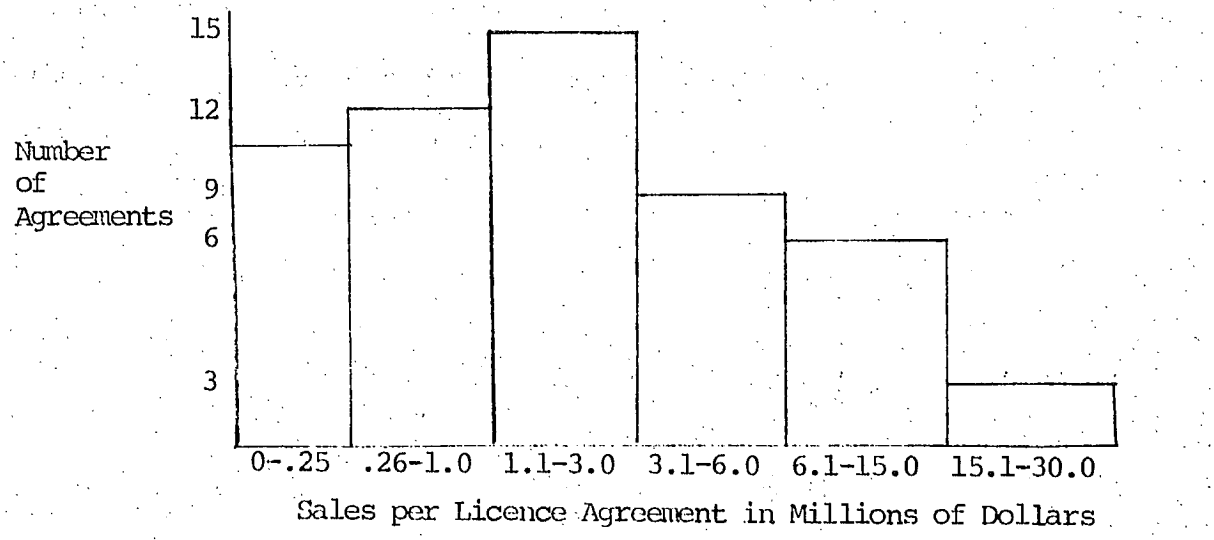
As the figure indicates, most firms licensing are involved in more than one licence agreement, but most productive units (small firms or divisions) which license have only one agreement, and very few have more than two.

The volume of sales made under licence in 1973 per agreement ranged from a few thousand dollars in the case of several agreements under which production was just beginning, to 30 million dollars. The mean sales volume per licence was $3.7 million. The distribution is

shown below.

Figure 5-5

Sales per Licence Agreement



As can be calculated, the total number of licence agreements included in Figure 5-5 is 54, eight less than the total of 62 in the sample. This is because three of the agreements covered only minor components of finished products, and to use the sales volume of the finished product as a statistic would be very misleading. For this reason these licences are excluded. In addition one firm, with five licence agreements, did not report this data.

In Chapter One data collected by Statistics Canada concerning the percentage of sales made under licence by Canadian licensees was presented. (Figure 1-6). One-third of the firms had sales made under licence representing less than 10% of total sales, and almost another third had sales made under licence comprising more than 75% of total sales. At the time this data, which includes foreign and Canadian owned licensees, was presented, it was speculated that most medium to large

Canadian owned manufacturing licensees, for which these 21 firms are the population, is significantly different than that for all Canadian licensees. This speculation is supported by a chi squared test which rejects the hypothesis that the percentage of sales made under licence by a firm is independent of the nationality and size of the firm at the .05 level. The chi squared test and significance level are explained in the appendix to this chapter.

Figure 5-6

Percentage of Sales Made Under Licence

Percentage of Sales Made Under Licence	All Canadian Licensees		Medium and Large Canadian Owned Licensees	
	Number	Percentage	Number	Percentage
under 10%	253	33.4	11	55
10 - 20%	75	9.9	4	20
21 - 30%	46	6.1	1	5
31 - 50%	65	8.6	4	20
51 - 75%	69	9.1	-	-
over 75%	249	32.9	-	-
Total	757	100.0	20*	100

* These data were not available for one firm in the research sample.

Most of the firms in the sample made less than 10% of total corporate sales under licence. None made more than 50% under licence. Clearly it is the smaller licensees or the foreign owned licensees which are making a high percentage of their sales under licence.

3. Export Restrictions

In Chapter Two two sets of data were presented on the frequency of export restrictions in agreements entered by Canadian firms. One set, published in the Gray Report, and based on proposed licence agreements rather than completed ones, indicated that 58% of the agreements

restricted the licensee to operating only in Canada. The second set, published by Statistics Canada and covering 510 licence agreements in which Canadian owned firms were involved in 1972, indicated that only 24% of the agreements did not allow the licensee to export.

The data in this research, pertaining to medium and large Canadian owned manufacturing licensees, gave much the same result as that of the Gray Report. 60% of the licence agreements covered in this study prevented the licensee from exporting from Canada. The only reasonable possibility for reconciling this figure with the 24% of Statistics Canada seems to be that agreements relating to minor process details, of which there seem to be many, do not contain export restrictions on the final product made by the process. Such agreements are not included in this study, and would have been included in the Statistics Canada survey.

What is highly significant for the central question of this research - whether or not licensing is a viable growth strategy for Canadian owned secondary manufacturing firms - is that over half of the agreements entered by Canada's largest secondary manufacturing firms relating to specific products do not allow the firms to export these products. This question is examined further in the second half of this chapter, where the hypothesis that there is a correlation between the frequency of export restrictions and the type of licence agreement is tested.

4. Procurement Restrictions

Procurement restrictions were insignificant in the licence agreements examined in this research. Only one agreement involved such a restriction, and the licensee stated that it would have been buying

from the licensor in any case, as it is the only supplier of the material in North America. This low frequency of procurement restrictions is supported by the statistics in the Gray Report and those presented by Statistics Canada, as quoted in Chapter Two.

Far from it being a problem, many licensees considered the opportunity to buy components from licensors as a major benefit of entering licence agreements. Typically these would be low volume components which could not be economically produced to serve only the Canadian market. The usual pattern was that the licensee would buy many components when Canadian sales were low, gradually producing more in-house as sales rose. More will be said on this subject in Chapter Six.

Part Two

Hypothesis Tests

1. Uncertainty

The first hypothesis presented in Chapter Four was that licensees with a relatively high proportion of scientists and engineers in their employ (i.e. Type One licensees) will introduce products in environments of higher technical uncertainty than will firms with a relatively low proportion of such personnel.

Productive units were ranked according to the proportion of their total employment accounted for by qualified scientists and engineers and a natural gap was found to exist around 3.5%. For this reason it was decided that productive units with greater than 3.5% of total employment consisting of qualified scientists and engineers would be classified Type One licensees. There were 11 productive units in such a category, involved in a total of 16 licence agreements.

In total, technical uncertainty information was provided for 52 licence agreements, 16 held by Type One licensees, and 24 held by Type Two and 12 held by Type Three licensees. Respondents were given a choice of high, medium or low, in replying to the question of the level of technical uncertainty when the product was first put into production. The frequency distribution is shown below.

Figure 5-7

Technical Uncertainty Distribution

Licences Held By	Level of Technical Uncertainty			
	Low	Medium	High	Total
Type One	4	6	6	16
Type Two	21	3	0	24
Type Three	5	4	3	12
Total	30	13	9	52

The hypothesis will be tested using the chi squared test for independence. The responses for Types Two and Three will first be combined. The purpose of the test is to determine whether or not the two characteristics, level of technical uncertainty and licensee type, shown in the table of Figure 5-7 are independent of each other, meaning that the distribution of one characteristic would be the same regardless of the value of the other. In this case, if licensee type and uncertainty level are independent, the same proportion of low, medium and high technical uncertainty responses should occur for Type One licensees as for Types Two and Three. These proportions refer to the population of each type of licensee, not the sample. In this and the cases to follow the sample, although not random, is assumed to be representative of the population with respect to the characteristics of the licences to be discussed.

The format of the chi squared test is that the null hypothesis that the characteristics are independent is tested. If it is rejected the alternate hypothesis, that the characteristics are not independent, is accepted. In this case these would read as follows:

HO: (null hypothesis) Licensee type and level of technical uncertainty faced when a new product is introduced are independent.

HI: They are related or dependent.

Details of the chi squared statistic and level of significance of the test are explained in the appendix and will not be related here. In this case the computed chi squared value is 11.17 which is significant at the .005 level. This means that the null hypothesis is strongly rejected, and that licensee type and the level of technical uncertainty faced when a new product is introduced are related. Further, from examining the frequency distributions it may be said that a greater proportion of Type One licensees introduce products at levels of higher technical uncertainty than do Type Two and Three licensees.

A word of caution is in order regarding the test just made. As revealed in the appendix, expected frequencies, that is the distribution expected in each cell of Figure 5-7 if the characteristics are independent, are a part of the chi squared calculation. There is a rule of thumb that for an accurate chi squared value none of the expected frequencies should be less than one, and not more than 20% less than 5.[2] If either of these conditions are violated the resulting chi squared value will be artificially high. The expected frequencies for Figure 5-7 are shown below in Figure 5-8. For any position these

are obtained by multiplying the row total by the column total and dividing by the grand total.

Figure 5-8

Expected Frequencies

Licences Held By	Level of Technical Uncertainty			
	Low	Medium	High	Total
Type One	9.2	4.0	2.8	16
Type Two and Three	20.8	9.0	6.2	36
Total	30	13	9	52

As can be seen from the table, none of the expected frequencies are less than one, but two of the six are less than five. Thus the rule of thumb that less than 20% of the expected frequencies should be less than 5 is broken and resulting chi squared value should be treated carefully. In this case, since the rule of thumb is almost met, and since the computed chi squared value is much higher than that needed for significance at the .05 level (5.99), which is considered adequate for this research, the original decision to reject the null hypothesis will be maintained, although it should not be considered to have been rejected at the .005 level, as a face value reading of the chi squared value would suggest.

This rule of thumb will be checked on all of the following chi squared tests, but will not be reported in the text unless it has been violated, as it has in this case.

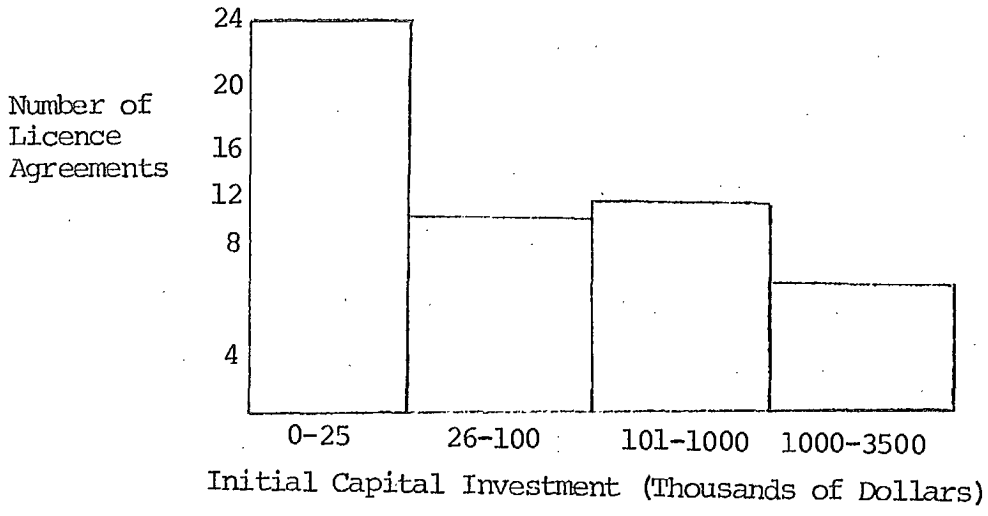
In summary, the first hypothesis, that Type One licensees will introduce products in conditions of higher technical uncertainty than Type Two or Three licensees, is supported.

2. Investment

The second hypothesis to be tested is that licensees with complete core skills (i.e. Types One and Three) will make a larger initial capital investment than those with incomplete core skills (i.e. Type Two). Initial capital investment figures were obtained for 53 of the 62 licence agreements. These ranged from nothing at all to $3.5 million with an overall average of $347 thousand. The distribution is shown below.

Figure 5-9

Initial Capital Investment by Licensees



Thirteen of the 53 licences on which investment data is available were held by Type One licensees, 28 by Type Two, and 12 by Type Three. The average initial capital investment of the Type One licensee was $698 thousand, Type Two $243 thousand, and Type Three $210 thousand. These averages can be somewhat misleading in view of the fairly small number of observations in categories One and Three. One large investment in either category can change the average dramatically. The median for agreements held by Type One licensees was $100 thousand, Type

Two $5 thousand and Type Three $125 thousand. Thus the category with the lowest average investment has the highest median investment. The distribution of initial capital investment by licensee type is shown below.

Figure 5-10

Initial Capital Investment by Licensee Type

Licence Held By	Investment in Thousands of Dollars			
	0-50	51-499	500-3500	Total
Type One*	5	4	4	13
Type Two	20	3	5	28
Type Three	3	7	2	12
Total	28	14	11	53

* The total sample included 16 agreements held by Type One licensees. However, three of these concerned minor components, which did not determine in any way the investment or product life cycle stage of the finished product. For this reason these are excluded from this and the following section.

In order to test the second hypothesis the data shown for Types One and Three in the above figure were combined and a chi squared test carried out. The null hypothesis that initial capital investment is independent of licensee type was rejected in favour of the alternate hypothesis that the two are related and that the initial capital investment made by Type Two licensees tends to be lower than made by Type One and Type Three. The calculated value of chi squared was 9.67, which is significant at the .01 level. The second formal hypothesis of the research has been supported.

To ensure that the data presented in Figure 5-10 were not simply

a reflection of licensee size, data were collected to examine the relationship between initial capital investment and the size of the licensee; the latter measured by the sales of the total firm, not the productive unit, in the year the investment was made. The average sales volume of firms investing $50 thousand or less was $84 million, between $50 thousand and $500 thousand was $76 million, and over $500 thousand was $63 million. No clear pattern is in evidence, and certainly the largest firms do not appear to be making the largest investments. The data in Figure 5-10 is not merely a result of firm size.

The fact that the second hypothesis has been supported should not be allowed to obscure the fact that there is considerable variance in the investment figures, and that some licensees are certainly not acting as hypothesized. The Type Two licensee category, which is of particular interest to this research, contained 11 agreements for which absolutely no capital investment was made by the licensee, yet also contained a firm making an initial capital investment of 1.5 million dollars and another of 3 million dollars. It should be noted that the greatest proportion of investments over $500 thousand were made by Type Two licensees (5 out of 11).

It is clear that most firms with incomplete core skills are acting as hypothesized and making very small or no capital investment to begin production under licence. However a significant minority are investing large amounts. A closer examination of these Type Two large investors will be made in Chapter Six and reasons for their behaviour offered.

3. Product Life Cycle

Hypothesis Three states that firms with complete core skills

will operate earlier in the product life cycle than those with incomplete core skills. As indicated earlier only two stages of product life cycle will be distinguished here, "early" and "late". Product life cycle data was obtained on products produced under 48 licence agreements. In 35 of these the licensee had begun operations early in the product life cycle, producing and marketing the product before or within a year of the product introduction by its competition. In only 13 cases was the licensee later than this. The distribution by licensee type is shown below.

Figure 5-11

Product Life Cycle Stage by Licensee Type

Licences Held By	Early	Late	Total
Type One	12	1	13
Type Two	13	10	23
Type Three	10	2	12
Total	35	13	48

In order to test the third hypothesis the responses for Types One and Three were combined and the null hypothesis that product life cycle stage is independent of licensee type was tested. The chi squared value was computed to be 4.52 which is significant at the .05 level. Thus the null hypothesis was rejected and the alternate, that there is a relationship between licensee type and product life cycle stage at which production begins under licence is accepted. Examination of the distributions of Figure 5-11 indicates that not only are licensee type and product life cycle stage related, but that Type Two licensees have a propensity to begin production later in the product life cycle than the others.

As in the previous hypothesis test, this hypothesis has been supported, but with some surprising data included in the sample. The arguments in the first four chapters of the thesis would definitely not suggest that over 50% of Type Two licensees would begin production in the early stage of the product life cycle. In spite of the fact that the third hypothesis was supported, something is clearly amiss. Unlike the second hypothesis, further investigation is presented here, rather than delayed until Chapter Six.

It will be recalled that the basis for the hypothesis concerning complete/incomplete core skills and product life cycle stage was based on the ability of a licensee to operate in conditions of technical uncertainty. More specifically, it was argued that licensees with incomplete core skills would be unable to operate in conditions of high technical uncertainty. It was also postulated that Type Two licensees (those with incomplete core skills) would face an environment of high technical uncertainty at the beginning of the product life cycle. One of these two propositions has to be wrong. Either Type Two licensees can operate under conditions of high technical uncertainty, or there is not high technical uncertainty for these firms at the beginning of the product life cycle. Since the data collected to test hypothesis one have already supported the contention that Type Two licensees do not operate in conditions of high technical uncertainty, the second assumption, relating technical uncertainty and product life cycle stage will be examined. The data below are for Type Two licensees, showing the relationship between technical uncertainty and product life cycle stage.

Figure 5-12

Technical Uncertainty and Product Life Cycle Stage

Type Two Licensees

		Level of Technical Uncertainty		
		Low	Medium	High
Product Life Cycle Stage	Early	11	2	-
	Late	9	1	-

It does not require a statistical test to see that the null hypothesis cannot be rejected in this situation. The level of technical uncertainty faced by the Type Two licensee is independent of the stage of the Canadian product life cycle at which it begins production. What is directly contrary to expectation is that 11 of the 13 licensees operating at the beginning of the product life cycle indicated technical uncertainty to be low.

Such a finding forces the researcher back into the literature of the product life cycle model. This concept has been tested elsewhere and found valid. Why should it not apply to Canada? Or is it that this researcher has incorrectly applied it to the Canadian situation? A close analysis reveals the latter to be the case.

To put it most concisely, what Vernon and Hirsch argue is that technical uncertainty begins to decline with a product's first world introduction, which for many labour saving products, would be in the United States. Thus it follows that the highest technical uncertainty will surround the product whenever it is first introduced in the world, and the uncertainty will decline over time, dating from that first world introduction. The product life cycle model says nothing about the level of technical uncertainty in a following country, such as Canada.

It will be assumed that the level of technical uncertainty at the time of the product's first production in Canada will be equivalent to that, at the same time, in the pioneer market. That is, if a product is introduced to the Canadian market soon after its world introduction when uncertainty is still high in the innovating country, it will be high for the Canadian producer. If the product is not produced in Canada until the technical uncertainty is low in the innovating country, it will be low for the Canadian producer.

Another way of considering the same concept is that if a firm begins production of a certain product in Canada 10 years after its world introduction, it will be done so in an environment of lower technical uncertainty than if it had done so 5 years after the world introduction, even if in both cases the firm is the first to produce in Canada. Thus the level of technical uncertainty surrounding the product is postulated to be a function of the product life cycle in the innovating country, and that of the following country is irrelevant. This interpretation is believed to be consistent with Vernon's model and will be tested with the data available.

This explanation is consistent with Crookell's findings. Crookell indicated that Canadian owned firms avoided the early stages of the Canadian product life cycle because of the high risk. This would be true, in the appliance industry, because as Crookell pointed out in the thesis, new product introduction in the U.S. is followed quite quickly by new product introduction in Canada. Thus the lag in years between the two product life cycles (U.S. and Canadian) is very small and at the time products are introduced in Canada the technical uncertainty in the U.S. is still high - and therefore it would also be in Canada if the

postulated relationship is correct. As a result, it is suggested that Crookell's analysis of the competitive problem of the Canadian owned firm applies primarily to those in industries in which there is a short lag between world introduction and Canadian introduction.

To test this possible explanation of the fact that technical uncertainty was low for many products even at the beginning of the Canadian product life cycle, the relationship between level of technical uncertainty and the gap in years between the time the Canadian licensee began production and the first world production will be examined. This will be done for Type One and Two licensees; Type Three being excluded since it was postulated that for this category of firm technical uncertainty would not be high even at the beginning of the product life cycle, and thus the decline over time would be slight. Data to examine the relationship are presented below. It should be noted that the average gap in years between licensee production and world production for firms beginning to produce in conditions of low uncertainty was 15.0 years, medium technical uncertainty 7.1 years, and high technical uncertainty 4.9 years.

Figure 5-13

Technical Uncertainty and Production Gap
Licences Held By
Type One and Two Licensees

		Level of Technical Uncertainty			
		Low	Medium	High	Total
Production	0-3	2	1	4	7
Gap in	4-10	8	3	-	11
Years	10-30	14	2	2	18
	Total	24	6	6	36

A chi squared value cannot reasonably be calculated for such an array since it contains too many low frequencies. Six of the nine expected frequencies would be less than five, and the resulting chi squared value could not be relied upon. The root of the problem is that there is too little data in the medium and high technical uncertainty categories. To surmount this problem these two categories are combined and the test will be made using only two categories of technical uncertainty, "low" and "medium-high". Such a combination allowed a valid chi squared value of 5.75 to be calculated, which allows rejection of the null hypothesis of independence at about the .06 level. This permits acceptance of the alternate hypothesis that there is a relationship between the technical uncertainty level experienced by a firm and the gap in years between the time it is beginning production and first world production. The longer the gap the lower the technical uncertainty.

Having established that there is a relationship between technical uncertainty level and production gap, what was originally Hypothesis Three will now be restated. The new hypothesis, which will be labelled 3A, is again based on the reasoning that firms with incomplete core skills will not be able to operate in areas of high technical uncertainty. Level of technical uncertainty will now be measured not in terms of the Canadian product life cycle, but in the years elapsed since first world production.

Hypothesis Three A

Licensees with complete core skills will begin production of a product sooner after that product's world introduction, than will firms with incomplete core skills.

The data to test this hypothesis is presented in Figure 5-14.

Figure 5-14

Licensee Type and Production Gap

Licences Held By	Production Gap in Years			
	0-3	4-10	10-30	Total
Type One	6	4	3	13
Type Two	1	8	14	23
Type Three	5	4	3	12
Total	12	16	20	48

In order to test the null hypothesis that licensee type and production gap are independent the data for licensees with complete core skills (Type One and Type Three) was combined, and a chi squared value of 11.5 calculated. This leads to rejection of the null hypothesis at the .005 level and grants acceptance of the hypothesis that production gap and licensee type are related. This is a very strong relationship. Type Two licensees, with incomplete core skills, have a marked propensity to allow a longer time to pass since a product's world introduction before taking up production of it themselves, than do the other licensees. The average gap for Type One licensees was 6 years, for Type Two licensees was 16 years, and for Type Three licensees was 8 years.

The conclusion of the arguments and the data presented in this section is that technical uncertainty is not necessarily high at the beginning of the product life cycle for Type Two licensees, although it may be if there is a short time between the world introduction and

the first Canadian production (as is the case in the Canadian appliance industry). This in turn means that Type Two licensees can operate at the beginning of the product life cycle, in situations where there is a long gap between the world introduction and first Canadian production. As will be indicated in Chapter Six, those Type Two licensees which do operate at the beginning of the product life cycle tend to be those which are not competing against foreign subsidiaries.

4. Export Restrictions

The fourth hypothesis presented in Chapter Four stated that firms with licence agreements involving continuous technology transfer will more often face export restrictions than will be the case for firms with agreements involving a one time transfer of technology. In order to test this hypothesis a slight deviation from the normal analysis based on licensee types is made. All Type Two licence agreements are of the continuous transfer type, all Type Three are one time agreements, and Type One agreements involve both types. The data for each category is shown separately below and then restrictions for all continuous as well as one time agreements are totalled, for the chi squared calculation. Export data were available on 56 licence agreements.

Figure 5-15

Export Restrictions

Licensee	Allowed to Export		
	Yes	No	Total
Type One-continuous	1	3	4
-one time	9	3	12
Type Two-continuous	5	23	28
Type Three-one time	9	3	12
Total	24	32	56

In total 6 continuous agreements allow exporting, 26 do not; 18 one time agreements allow exporting and 6 do not. The chi squared value calculated for these figures is 15.5 permitting rejection of the null hypothesis at the .005 level. There is a significant relationship between type of licence and the incidence of export restrictions, with a much greater proportion of continuous agreements containing export restrictions than is the case for agreements involving a one time transfer of technology.

There were no surprises in this section, the data supported the hypothesis much as was expected.

Summary

This chapter has dealt with the formal testing of the hypotheses of this research. Three of these four hypotheses were supported, and one new hypothesis was developed, tested, and supported. The data presented in the chapter also raised several questions which will be carried into the next chapter.

In this chapter the characteristics of the three types of licensees began to emerge. Not only in terms of common traits such as operating in high or low technical uncertainty areas, or making large or small capital investments, but also in terms of the degree of homogeneity of the groups with respect to certain characteristics. Type Three licensees show very little variance in capital expenditures, Type Two licensees are very homogeneous in terms of the technical uncertainty in which they operate, and so on.

The bare statistical outline presented in this chapter will be augmented in Chapter Six with descriptive details, as well as analysis of some of the subgroups within each licensee type. The

emphasis will shift from the licence agreement as the basic unit of analysis to the company. Corporate motives and attitudes will be presented and attention will be paid to the validity of the pure market assumption. Licensing will be considered as a strategy.

Chapter Five

Footnotes

1. This calculation is very approximate because the CALURA data does not segregate primary and secondary manufacturing industries. Those categories clearly representing primary industry were excluded from the calculation, but a completely accurate separation was not possible.
2. W.J. Dixon and F.J. Massey, Introduction to Statistical Analysis, (New York, McGraw-Hill Book Company, 1969), p.238.

Chapter Five

Appendix

The Chi Squared Test

In this research observations are frequently classified according to two characteristics. For instance, licence agreements are classified by licensee type and initial capital investment in Figure 5-9. The chi squared test is used to determine if these two characteristics are independent. Independent is taken to mean that the distribution of one characteristic is the same regardless of the other.[1]

The standard method of carrying out a chi squared test is to first formulate a null hypothesis in terms of the population. This hypothesis postulates that the two characteristics are independent. In the example mentioned above the null hypothesis would read:

> HO: There is no relationship between licensee type and the amount of initial capital investment made to begin production of a product under licence.

A sample is drawn from the population to test the hypothesis. For a chi squared test this is to be a random sample. As explained in the text, the sample used in this research, although not random in terms of the size of licensee, is believed random with respect to licensee type and licence characteristics. If the test made on the sample indicates that the null hypothesis should be rejected, this is equivalent to saying, "HO is false" and leads to the opinion that "H1 is true", where H1 is the alternate hypothesis. The alternate hypothesis is simply the negation of the null hypothesis, as explained in the text. The

decision to accept the null hypothesis is not equivalent to the opinion "HO is true", but rather "HO has not been shown to be false", which could be simply due to a lack of evidence.[2]

In the initial investment example the sample is classified according to the two characteristics of interest, as shown in the Figure below, which is a restatement of Figure 5-9.

Figure 5A-1

Initial Capital Investment by Licensee Type

Investment in Thousands of Dollars

Licensee	0-50	51-499	500-3500	Total
Type One and Three	8	11	6	25
Type Two	20	3	5	28
Total	28	14	11	53

This is known as a contingency table. It is assumed for a chi squared test that each observation can be categorized in exactly one of the categories or classes. The formula for calculating the test statistic for a chi squared test is:

$$T = \sum_{i=1}^{r}\sum_{j=1}^{c} \frac{(Oij-Eij)^2}{Eij} \quad \text{where} \quad Eij = \frac{n_i C_j}{N}$$

and r = number of rows in the contingency table

c = number of columns in the contingency table

O_{ij} = the observed number in the cell (i,j)

E_{ij} = the expected number of observations in the cell (i,j) if HO is really true.

n_i = the row totals

C_j = the column totals

N = the grand total

Before the test statistic can be calculated the E_{ij}, the expected number of observations in each cell, must be calculated. This is done using the formula above. The figure below gives the expected frequences for the contingency table in Figure 5A-1.

Figure 5A-2

Expected Frequencies

Investment in Thousands of Dollars

Licensee	0-50	51-499	500-3500	Total
Type One and Three	13.2	6.6	5.2	25
Type Two	14.8	7.4	5.8	28
Total	28	14	11	53.

These are the frequencies for which the rule of thumb that not more than 20% may be less than 5 and none may be less than 1.0 applies.[3] The test statistic may now be calculated, using the formula previously presented. In this case its value is 9.67. In order to determine at what level of significance this test statistic will reject the null hypothesis, or conversely to see if the null hypothesis can be rejected at a previously determined level of significance, the value of the test statistic is compared with the critical values of a chi squared distribution with (r-1)(c-1) degrees of freedom. In this case if the test statistic exceeds 9.2 the null hypothesis is rejected at the .01 level, if it exceeds 10.6 it is rejected at the .005 level. What these levels of significance mean is that there is only one chance in one hundred (at the .01 level) of rejecting a true null hypothesis.

Readers seeking an explanation of the chi squared test involving greater depth and a more theoretical approach are referred to the footnoted texts.

Chapter Five

Appendix

Footnotes

1. W.J. Dixon and F.J. Massey, Introduction to Statistical Analysis, (New York, McGraw-Hill Book Company, 1969), p. 240.
2. W.J. Conover, Practical Nonparametric Statistics, (New York, John Wiley and Sons, Inc., 1971), p. 77.
3. These "rules of thumb" vary, see Conover, p. 152; Dixon and Massey, p. 238; and Ya-lun Chou, Statistical Analysis, (New York, Holt, Reinhart and Winston, 1969), p. 450.

Chapter Six

The objectives of this research, as established in Chapter One, are to determine the conditions under which Canadian owned firms manufacture under licence, and to subsequently make a judgment as to whether or not manufacturing under licence is a viable growth strategy for these firms. In Chapter Five the first objective has been met. The conditions under which Canadian owned firms license have been established. The remaining task, of making a judgment of the viability of licensing as a growth strategy for Canadian owned firms, will be carried out in the final chapter. The purpose of this intermediate chapter is to go beyond the statistics of Chapter Five and present observations made on motives, attitudes, and strategies. These observations, as much as the statistically significant mass data, will form the basis for the growth judgments of Chapter Seven.

The emphasis on Chapter Five was between types of licensees, in this chapter attention is focussed within each of the licensee types. Situations which do not carry statistical significance but which are judged important are presented. Because of the small sample sizes, the observations made in this chapter must be considered more tentative than those of Chapter Five.

The chapter includes a section on each of the three types of licensee. The data scattered through Chapter Five for each type of licensee is collected and summarized, and examined for anomalies, results not predicted by the research model. Particular attention is paid to licensing motives, and here the analysis shifts from a focus on the licence agreement to focus on the licensing firm. What is its

situation, why is it licensing? Licensing is thus considered in strategic terms. For Type Two licensees this strategic analysis is developed at length, and a clear distinction based on statistically significant data is made between two quite different corporate strategies, each based on licensing. The section on Type Two licensees also includes observations on the validity of the pure market assumption.

1. Type One Licensees

In Chapter Five a number of facts were established concerning the sample of Type One licensees. These are presented below.

1. By definition, all Type One licensees have a relatively high research and development competence, with more than 3.5% of total employees consisting of qualified scientists and engineers.
2. The Type One licensees were capable of operating in conditions of high technical uncertainty, and introduced products under licence in such conditions approximately one third of the time. Since product introductions were equally frequent in conditions of medium or low technical uncertainty, it is tentatively concluded that there is no marked preference by these licensees toward or away from any level of technical uncertainty.
3. Similarly, the Type One licensees showed an equal propensity for launching products under licence which necessitate low, medium and high amounts of capital. Of the thirteen agreements for which such data was relevant, 5 involved up to $50 thousand initial capital investment, 4 were between $51 thousand and $499 thousand, and 4 involved $500 thousand or more.
4. Nearly all (12/13) of the Type One licencees began production at the beginning of the Canadian product life cycle.

5. Approximately half of the Type One licensees began production of a product within 3 years of its world introduction, two thirds within 10 years, and all within 20 years.
6. Seventy-five percent of the licence agreements entered by Type One licensees involved one time technology transfer, 25% were of the continuing transfer type.
7. Exports were not allowed in 6 of the 16 licence agreements.

In view of the research model presented in Chapter Four, three of these observations are quite surprising. Firstly, it is surprising that any of the licensees, which are by definition technically competent, are involved in licence agreements of a continuing nature, which implies restrictions and a continued technical dependence on the licensor. Secondly, one would not expect that one third of these licensees' new products would be introduced more than 10 years after the products' first world introductions. One would expect firms with research and development competence to move more quickly in following someone else's lead. Finally, it was surprising to find such a high percentage of licence agreements (37.5%) not allowing the firm to export. It was thought that firms in this category would have the flexibility to be able to avoid accepting licences with such conditions.

To explain as far as possible these unexpected findings a further analysis of Type One licensees will be carried out. These licensees will be categorized according to the type and frequency of information they are receiving from the licensor. The reasoning for this classification goes back to the Chapter Two section on technology transfer which placed emphasis on the actual flows of information between firms. The dichotomy established then between commercially

proven and not commercially proven technology did not prove particularly effective in explaining the unexpected findings just identified. A similar but slightly different criterion was found more useful. The distinction will be made between agreements which only give the licensee the legal right to infringe a patent, and those which provide technical knowhow as well. A second distinction will be made for know-how agreements depending upon whether they are one time or continuing agreements. All "patent rights" only agreements proved to be one time agreements. The chart below indicates the number of Type One licensees and licence agreements in each category.

Figure 6-1

Type One Licensees

Information Received from Licensor

	Number of Productive Units	Number of Licence Agreements
Patent Rights Only	3	6
Patent Rights plus Know How:		
One Time	5	6
Continuing	4	4

The division of licensees and licences into these categories leads to the conclusion that the three unexpected observations mentioned earlier, referring to export restrictions, production lags, and continuing licence agreements, are closely related. The evidence suggesting this is presented in the diagram below, which contains data on export restrictions and production lags in the categories established in Figure 6-1.

Figure 6-2

Type One Licensees

Export Restrictions and Production Lags

	Number of Licence Agreements	Percentage of Agreements not Allowing Exports	Percentage of Cases with Production Lag More Than 10 Years
Patent Rights Only	6	nil	17%
Patent Rights Plus Know How:			
One Time	6	50%	nil
Continuing	4	75%	50%

Although the numbers involved are too small for statistical significance, it seems that export restrictions follow a definite pattern. The more information the licensee receives from the licensor, the more likely it is to face export restrictions. When only a legal permission is given, with no flow of technical information, there are no export restrictions involved, at least in this sample. When technical know how is included export restrictions are more frequent, and most frequent when that know how is provided on a continuing basis.

The second column shows that for 2 of the 3 instances in which the production gap between first world production and first Canadian production was more that 10 years, the licence agreement was one which provided for a continuing flow of technical know how. Thus most of the unexpected data, both in terms of export restrictions and production lag, is related to the fact that some Type One licensees are involved in continuing licence agreements.

Viewed in this light, the export restriction and production gap data is consistent with results obtained in Chapter Five, pertaining to continuous licence agreements. The results of the test of Hypothesis

Four clearly indicate that a high proportion of continuing licence agreements would be expected to contain export restrictions, and hypothesis 3A stated that the products introduced by Type Two licensees, those with continuing licence agreements, would have on average the largest production gaps. These hypotheses are supported by the continuing licence agreements of Type One licensees.

Thus the only real surprise in the data pertaining to Type One licensees is simply that there are some firms in this category operating with continuing licence agreements. A close examination of these firms reveals that the assumption of research and development competence is in most cases at fault. In one case the licensing division is so small that the employment of only a couple of engineers was enough for inclusion of the division as a Type One licensee. However, three engineers do not give this licensee a research and development competence. In another case the firm's competence is in the construction of capital equipment and many engineers are involved in the superficial design and in the construction process. These engineers are not, however, involved in the fundamental product design; the firm relies on the licensor for this. The other two licensees in this category are in closely similar circumstances. The conclusion is that these four productive units, although meeting the operational definition of Type One licensees, would be more accurately classified as Type Two licensees. They do not have a research and development competence and rely on the licensor for new technology on a continuing basis. The motives and growth potential of these licensees is more accurately reflected in the section on Type Two licensees than in those which follow, pertaining to licensees with a research and development competence.

(a) Licensing Motive

It was suggested in Chapter Four that to a Type One licensee, a licence agreement is a matter of convenience, the result of an elementary economic calculation. The licensee was presented as a firm with high research and development competence capable of designing around a competitor's patent, but which found it less expensive to accept a licence from the competitor, and therefore entered a licence agreement. Implicit in this model of the licensee is the assumption that the licensee is not learning anything from the agreement, but is merely receiving legal permission to do something of which it is already capable.

This portrait is accurate for some Type One licensees, but certainly not for all. Each licensee is in at least slightly different circumstances and licensing for somewhat different reasons. A variable which seems useful for distinguishing the licensing motives of Type One licensees is whether or not the licensee is learning new skills from the licensor. This idea is related to the core skills concept. Some firms enter licence agreements and have their core skills changed not at all, while those of other licensees are changed dramatically. The continuum stretching from no learning at all to very great learning will be divided into three categories for convenience of analysis. Licensees will be categorized according to whether nothing is being learned from the licensor, product knowledge is being learned from the licensor, or a whole new technology is being learned from the licensor. With the exception of those firms with continuing licence agreements whose motives are considered in the section on Type Two licensees, the distribution of Type One licensees and licence agreements is shown below.

Figure 6-3

Type One Licensees

Licensing Motives

	Number of Productive Units	Number of Licence Agreements
No Learning	3	6
New Product Knowledge	3	4
A New Technology	2	2

Licensees operating in each category are described in the following sections.

No Learning

The basic motive of firms in this category is to develop and market a new product. This is the primary decision made by the firm, and the decision to enter a licence agreement to help attain the goal is strictly secondary. It is usually the case that in the process of development the firm's researchers come across patents held by a competitor and evaluate these patents with a view to designing around them. Only at this stage is taking a licence agreement considered.

The specific motive for taking a licence agreement is the trade-off between paying for the legal right to infringe the competitor's patent, and designing around it. As one divisional manager explained:

> We're not out to reinvent the wheel. If a competitor has a patent useful to us we'll usually license it. This is done throughout the ..... industry. The royalties aren't high, and anyway, most of our licensors are also our licensees. With this kind of cross-

licensing our net payment is insignificant.

The history of this particular division is very interesting. The apparently facile remarks of the manager disguise a great effort by the firm to develop a research competence and be in a position to trade patents with competitors. In the early 1960's the firm was involved in a large number of licence agreements with five licensors and these involved technical know how as well as patent rights. The royalties on these agreements proved to be very expensive, approximately half a million dollars per year on total divisional sales in the range of $20 million. The company had at the time a research engineering department totalling 40 people. The decision was made at the presidential level that the firm must reduce its royalty payments and reduce its technical dependence on outsiders. Beginning in 1964 a conscious effort was made to expand and upgrade the research department, and to develop a portfolio of defensive patents. The twin objectives of reducing royalty payments and dependence on competitors were met. The success of the strategy can be judged by the fact that the division now trades patents to obtain the rights to those which it needs, and the royalty outflow is low. In addition it seldom enters know how agreements, which generally carry a higher royalty rate than straight patent agreements. This division is currently involved in licence agreements with four very large licensors, all of which are patent rights only agreements, and three of which are part of cross licensing arrangements. The research engineering department now consists of 160 people. This division will be referred to again with respect to the licensing cycle hypothesis presented in Chapter Seven.

It should be mentioned that firms in this category are the

same as those in the Patent Rights Only category of Figure 6-1. The firms not adding to their core skills with their licence agreements are those not receiving know how from the licensor. To these firms taking a licence is strictly a less expensive way of achieving an existing goal, the introduction of a specific new product. It is likely that the goal will be achieved even if the potential licensor decides not to grant the licence. To this small sample of 3 productive units, the licence is important, but not critical for survival.

New Product Knowledge

Firms licensing in order to obtain technical know how and patent rights pertaining to a specific product are generally in a different situation than those firms of the first category. These firms were not already working on the development of a product and then decided to take a licence as a means of reducing the development cost, as in the previous situation. In this case the licence generally pertains to a product closely related to the products already produced by the firm. Seeing this, and deciding it would be a worthwhile addition to the product line, the firm takes up the licence, receiving technical know how as well as patent rights. Because of the close relationship between the new product and the existing product line the firm is capable of taking over development of the product once the transfer of technical ideas has been made. Thus the motive for licensees in this category is to quickly and easily make an addition to their product line which is complementary to, but extends, the firm's existing skills.

A vice president of a firm licensing new product technology stated:

> When we saw the new product introduced in the States we just had to have it. The ..... concept is the greatest development in our industry since the beginnings of our current product line.... in 1933. This is the product of the future.

With respect to the process of obtaining the licence he added:

> We got a licence from ....., a company we have known well for a number of years. In fact we started a joint venture together about 10 years ago. They bought out our share a few years ago. It took us about a year to get this new process up and running properly. We spent a lot of time down there in the early months and later they sent some people up here to help iron out the bugs. Our investment in the new product is about $3.5 million.

In a final comment related to developments made since the technology was transferred to his firm the vice president commented:

> Now we have expanded the original range of products and in fact we are now licensors to .... (the original U.S. licensor) for a modification we have made in the process.

This story, with minor variations, was heard from each of the licensees in this category. Once again it must be emphasized that characteristics of licensees in this category is based on a sample of only three productive units engaged in four licence agreements.

A New Technology

Although small in terms of number of licensees and licence agreements, this category is very important. Two Canadian owned firms, both with research and development competence in their own specialities, were involved in licence agreements providing for a massive transfer of technology. This transfer was such that it brought the licensees not just a new product, but a new technology which could be translated into a variety of products. In neither case is it likely that the Canadian owned firm could have devoted sufficient financial resources or research personnel to have developed a competence in the new technical area, even though in both cases the new technology was in some way related to the firm's existing technical competence. In short, these firms were significantly expanding their core skills and moving into new areas of technology, drawing on the skills of pioneers, who were selling their newly developed technology under licence. In one case the Canadian firm was the licensor's only licensee in the world, in the other situation the Canadian firm was one of only two licensees outside the U.S. The two cases are interesting to compare because one featured the involvement of the Canadian government, and the other was arranged totally in the private sector.

The instrumental force in the private sector agreement was the American licensee, a very large firm selling an auxiliary material used by the firms who bought the equipment produced by the Canadian firm. In the interests of confidentiality which was promised to the participants in this research, the actual material will not be specified. Instead a reasonable analogy, that of welding equipment, will be used. Picture the Canadian company as a producer of very advanced welding

equipment, and the American company as a supplier of the oxygen needed by the customers of the Canadian firm to run their equipment. In the early 1970's the U.S. firm made a breakthrough in terms of a new type of oxygen mixture, say, which requires special equipment, but will produce far superior welds compared to the traditional method. The firm also built prototypes of the new welding equipment required. At this point the U.S. company contacted the Canadian firm to see if it would be interested in building this new equipment under licence. All the development work done by the licensor is made completely available, and some of this could result in other end products than those which are the subject of the licence agreement. The licensor will also supply technical marketing assistance to the licensee and even financing for the licensee's customers. Although restricted to the Canadian market, sales potential for the licensee looks promising because the new welded products of the licensee's customers will be greatly superior to those produced by the current method.

Thus a Canadian firm has been pushed to the forefront of a new technology by the resources and aggressiveness of a major U.S. supplier. The firm can now develop this technology in house and use it to develop other new products, which will also require the "oxygen" of the same supplier. Both of the Licensees, Canadian and Swedish, were chosen on the basis of their research and development competence in a field very closely related to the new technology.

The second case also involves a significant transfer of technology. In this situation the licence arrangement was forced by the Canadian government, who is one of the first customers of products based on the new technology. No company in Canada had the technology necessary

to fill the government's order, but the request for tenders specified that at least half of the units specified had to be built in Canada. This forced the foreign companies with the technology to prepare joint bids with Canadian partners. The winning bid was submitted by a Japanese-Canadian alliance, with the first half of the order supplied from Japan, and the second produced in Canada under licence by the Canadian partner. Because the Japanese firm had to find a Canadian partner, the Canadian firm was in a good bargaining position vis à vis export rights (which it obtained) and licensing terms. The immediate sale to the Canadian government by the licensee is for $12 million, and a variety of other applications can be made of the technology supplied by the Japanese. This point was included in comments made by the president of the company when listing the importance of the agreement to his firm.

> In addition to the substantial impact on our corporation, there are wider and larger terms which affect us very positively.
> Firstly, if we succeed in performing to the satisfaction of .. (the customer)..., we are very confident that future business will develop from this important customer.
> Secondly, the requirement for...(the product)... is spreading rapidly throughout the world and the fact that ..... (our customer)... is a world leader in this area will do much to help us develop a strong posture.
> Thirdly, the ..... technology itself has so many potential applications in addition to ..... (the product currently being made under licence)...., that we will be creating a

special development, engineering, and marketing group to seek out and exploit these opportunities.

Licence agreements such as these two seem to be very beneficial for the Canadian licensee. There are not many of them taking place. As mentioned in the section on cross licensing in Chapter Two, licensors with new technology representing significant breakthroughs prefer to exploit it themselves. The two situations described here are special cases - in one the Canadian government forced the technological pioneer to licence, in the other a supplier did development work not only on its own product but also on that of the Canadian firm. The licensor and licensee were in no way competitors.

The positive role played by the Canadian government will be referred to again in the final chapter of the thesis.

(b) Summary - Type One Licensees

An examination of the data collected in Chapter Five suggests that Type One licensees are not a very homogeneous group, but this apparent heterogeneity is reduced once it is realized that the operational definition of in house research and development competence has failed in several situations and that some of the licensees would be more accurately categorized as Type Two licensees.

The remaining agreements have been subdivided according to the nature of the information supplied by the licensor to the licensee. To the group receiving no new knowledge, only legal rights to infringe a patent, licensing is more properly considered a tactic than a strategy. That is, the firms' conscious planning and commitment of resources has to do with deciding that a new product is needed, what it should be, and that it should be developed in house. This is the strategic

decision, the decision to use licence agreements where useful is of secondary importance.

For firms which are receiving know how under licence the decision to enter a licence agreement seems to be of an opportunistic nature. The availability of the licence triggers the decision to introduce the new product. The decisions are made simultaneously. This is especially true for situations involving the transfer of a whole new technology. For these firms the taking of the licence is the strategic decision. Once again it must be emphasized that these sample sizes are small, and the conclusions tentative.

2. Type Two Licensees

As with Type One licensees, a set of characteristics pertaining to the Type Two licensee began to emerge in Chapter Five. The facts established in Chapter Five are summarized below.

1. By definition, all Type Two licensees have a relatively low research and development competence, with less than 3.5% of total employees consisting of qualified scientists and engineers. In addition, all Type Two licensees are in licence agreements involving a continuing transfer of technology.
2. Type Two licensees avoid operating in conditions of high technical uncertainty. Of the 24 Type Two licensees for which such data was available, 21 introduced products under licence in conditions of low technical uncertainty, 3 in conditions of medium uncertainty, and none at all in conditions of high uncertainty.
3. Most Type Two licensees made a very small initial capital investment to produce products under licence, but there were some significant exceptions. Over 70% of these licensees invested $50

thousand or less, but a surprising 17% invested $500 thousand or more.

4. Thirteen of the 28 firms for which such data were available began production at the beginning of the Canadian product life cycle.
5. Only one Type Two licensee began production of a product within 3 years of that product's first world introduction, approximately 35% of the 23 firms began production within 4 to 10 years, and roughly 60% within 11 to 30 years.
6. Exports were not allowed in 23 of the 28 (82%) licence agreements.

There were two surprises in these data, observations which did not coincide with the expectations established by the research model and its hypotheses. The first was the high proportion of products produced by Type Two licensees at the beginning of the Canadian product life cycle. This phenomenon was explained in Chapter Five. The second surprising fact noted in the data on Type Two licensees was that a significant minority of these firms made a very large initial capital investment to begin producing a product under licence. This is directly contrary to the prediction resulting from the research model, and will be examined further. An examination of the firms exhibiting such a characteristic immediately leads to a challenge to the pure market assumption.

(a) The Pure Market Assumption

The following explanation of the pure market assumption is quoted from the research model, Chapter Four.

> Licensor and licensee can exchange only hard information, such as technical specifications or other factual data.

> Information of a judgmental nature, such as that concerning future technology, may be transmitted, but cannot be received because the licensee does not know the licensor well enough to evaluate and have confidence in his judgment.

This assumption is absolutely critical in predicting the behaviour of Type Two licensees. It is this assumption that leads directly to the prediction that Type Two licensees will be so uncertain of future technology that they will be unwilling to invest heavily to begin producing under licence. They have no confidence that they will be able to keep abreast of technical change. This is the assumption, but what is the reality?

There were five Type Two licensees which made an initial capital investment of $500 thousand or more. These firms are immediately suspect with respect to the pure market assumption. An examination of the relationship between the firms and their licensors shows this suspicion to be well founded. To begin with the number of man days spent by employees of the licensee visiting with the licensor or vice versa was consistently higher for these firms than for other Type Two licensees. The average for the five high investors was 42 man days over the most recent 12 month period, and only 19 man days for other licensees. The mean difference, 23 days, is significant at the .01 level.[1] This means that there is only one chance in a hundred that these two samples could have been drawn from populations with the same mean.

A closer look at the licensor-licensee relationship for the

five licensees further supports the contention that employees of the two firms do come to know one another well and those of the licensee can learn to evaluate and trust the licensor's judgment. In one case the firms are located in immediately adjacent cities on either side of the Canada-United States border and telephone communication between the two firms right down to the draftsman level is frequent (daily) and encouraged. Many problems are solved over a downtown lunch. The co-operation between these two firms goes beyond the technical, however and extends to marketing issues. The Canadian firm, set up to operate with the short runs needed to supply the Canadian market also supplies all the orders below a certain size received by the U.S. licensor. The U.S. firm simply cannot produce economically in small runs. The licensee picks up a substantial volume of business in this way. This firm invested $3 million in equipment to produce the product under licence, the highest initial capital investment made by any Type Two licensee.

The second highest investment, $1.5 million, was made by a Canadian licensee which stipulated that a senior marketing manager employed by the licensor must come and work with the licensee for a period of two years, his salary to be paid by the Canadian company. When his term was up he was replaced with another of the licensor's top level marketing executives. In addition to this direct bond between licensor and licensee other personnel of the two firms spent 35 man days over a twelve month period exchanging visits.

At lower but still significant levels of initial capital investment, $500 thousand, the firms in the sample were using two methods of establishing close links with the licensor. One of these is to get to know the licensor by first importing its product into

Canada. This allows the Canadian firm an opportunity to evaluate the product, the Canadian market for the product, and the licensor. As import volume builds the Canadian firm stops importing and begins to manufacture the product under licence. A second method used by licensees to establish a bond with a licensor is to enter a "technical assistance agreement" rather than a straight licensing agreement. Such an agreement will be described further in the following section. In an agreement of this type the licensee is given total access to the knowledge of the licensor, not just to information pertaining to a specific product. In such a situation a strong bond is often formed between the personnel of the two companies.

The message of these examples is that the pure market assumption is important, critically important. It is important not just to the theory, but to the firms themselves. Managers of licensees with licence agreements involving a continuing transfer of technology are in many cases doing their best to violate the pure market assumption. As one manager of a Type One licensee in a continuing agreement put it:

> We only spent about 20 man days last year visiting ... (the licensor). It's too bad they're so far away (Sweden). But we're going to increase the figure. We've got to. They are world leaders in.... technology and we're going to get to know them better. It's only good business.

(b) Licensing Motive

In the descriptive portion of the research model it was suggested that the Type Two licensee licenses instead of developing an in house research and development competence. Such a licensee was

hypothesized to operate in an industry where such an in house competence was the norm, but the licensee hoped to use a continuing licence agreement to avoid making an investment in research and development. As was the case for Type One licensees, this picture painted in the research model is accurate for some, but not all of the licensees of this type.

There can be no division made among Type Two licensees based on continuing or one time licence agreements, or on patent rights only or technical know how transfer, such as there was for Type One licensees. All Type Two licensees are involved in continuing transfer agreements which include the transfer of know how. However the concept of relating licensee motive to the type of information received from the licensor is still valid and will be used again. In this case examination of the information flow between licensor and licensee reveals that some firms are receiving primarily technical information, other firms primarily marketing information, and a few getting both plus whatever else they feel they need from the licensor. This latter category consists of firms with technical assistance agreements.

The diagram below segregates Type Two licensees according to the type of information they are receiving from their licensors.

Figure 6-4

Type Two Licensees

Information Received from Licensor

Information Received	Number of Productive Units	Number of Licence Agreements
Technical	12	19
Marketing	4	6
Both* (Technical Assistance Agreements)	7	8

* Five of these technical assistance agreements were not included in the analysis of Chapter Five, as will be explained in the text.

The motives of licensees in each category will be considered in turn.

Technical Information

The majority of Type Two licensees and licence agreements are in this category of receiving primarily technical information on a continuing basis. The motives and situation of the four Type One licensees with continuing agreements are also accurately reflected in this section. The goal of all of these firms is to introduce a new product and keep it up to date with technology flowing from the licensor. These licensees are acting as predicted by the research model. They have a low research and development competence and rely heavily on the licensor for any and all product modifications.

The chairman of the board of one of Canada's largest licensees, which has seven licences in this category, explained the rationale for the firm's extensive licensing program. (The firm had over $60 million in sales made under licence in 1973).

> The basic reason we take licences is the small size of the Canadian markets for specialty products, which are so small that they cannot support meaningful research and development expenditures. It's not that we particularly like licensing, it's just that its the only way to get the technology to serve small specialized Canadian markets. Don't think we wouldn't like to do our own development, we would love to.

This rationale, that the Canadian market is too small to support the necessary research and development expenditures necessary to support

their products, was reported unanimously by the licensees of this category. With respect to the degree and type of dependence on the licensor, the quote below is one division manager speaking of another in the same company, the second operating a division which produces over 80% of its sales under licence.

> I don't know if I should tell you this but the ... division doesn't know what they're doing half the time. They're into technology that's away over their head. They're trying to put out too many products at once, all under licence. They aren't fully competent at any of them. I've seen half finished blueprints that they don't know how to complete ...

In summary, the firms in this category license instead of developing a research and development competence. They operate in industries where new technology is important, but license because the small Canadian market for their products cannot justify an investment in research and development. Many of the firms in this category are long time licensors, with a wide range of licensing activity. These 12 productive units are acting as predicted by the research model.

Marketing Information

This category of licensee was unexpected. Throughout the whole of the research model and its assumptions the emphasis was on technical information flow, technical uncertainty, and the initial problem was posed in terms of Canadian firms not doing their own research and development. Licensing was viewed solely as a means of transferring technical information, the output of a research and development group. The six licensees

in this category are using licensing as a means of obtaining a continuing flow of marketing information and assistance.

None of these firms have an in house research and development competence, nor are they operating in environments where such is necessary. In this sense they are like Type Three licensees, and this feeling is heightened by the fact that they only receive a one time transfer of technical information. It is only in the marketing sense that these licensees continue to be dependent on their licensors.

Speaking in terms of his company's motive to license to gain marketing information, the president of one of the licensees stated:

> Well, initially we chose... (the licensor)... because of their dominant position in the U.S. market. We liked their style - their whole marketing approach was good and their name well known in Canada due to advertising spillover. We didn't have much difficulty learning to make the product, no problems that way. Each year we hold a marketing meeting with them to look at new product samples and discuss trends. We can't use all their marketing approaches, some just wouldn't go over in Canada.

One issue raised in this statement is the similarity of the Canadian and U.S. markets for many products. It should be noted that none of the licensees obtaining marketing assistance on a continuing basis had licensors who were not American.

A second president is worth quoting with respect to marketing reasons for maintaining a licence, because of his noteable candour.

> Our relationship with our licensor is a mixture of respect

and fear. We don't need them technically any more at all, but we maintain the agreement even though the patents have expired. The licensor's name, which we sell under, is particularly important in Canada. Many of our customers are U.S. subsidiaries whose parents do business with the licensor in the States. They like to do business with us, because it's a good name. There are enough competitors in this business in Canada. If we dropped the licence they (the licensor) would start up a Canadian operation. That's the last thing we need!

The research model has not dealt with marketing skills. No measure of in house marketing competence has been devised, nor have the conditions leading to truncation of core skills in the marketing dimension been postulated. As a result no far reaching implications will be drawn from this sample of four licensees and six licence agreements. There is no theory to support such a move. However some observations will be made, concerning other variables than motive, which set this group apart from other Type Two licensees and may be useful to further research.

Firstly, only 11 of the 34 Type Two licence agreements dealt with consumer goods, defined as those sold in mass markets to individual buyers. The remaining 23 were for industrial products, those purchased by corporations. Yet 4 of these 11 consumer goods products were included in the 6 marketing assistance agreements, and 5 more were included in technical assistance agreements, which included marketing assistance. The breakdown is shown below.

Figure 6-5

Type Two Licensees

Consumer and Industrial Products

Information Received	Industrial Products	Consumer Products	Total
Technical	17	2	19
Marketing	2	4	6
Both (Technical Assistance Agreement)	4	5	9
Total	23	11	34

These numbers are too small to support a chi squared test. However it is apparent that firms receiving marketing assistance from their licensor on a continuing basis are most likely to be firms producing consumer products under licence. The same cannot be said for licensees receiving only technical information.

Secondly, a measure of marketing uncertainty at the time the product was introduced under licence was taken, similar to that taken for technical uncertainty. These data were supplied by only 25 of the Type Two licensees. The distribution of responses is shown below.

Figure 6-6

Type Two Licensees

Marketing Uncertainty

Information Received	Level of Marketing Uncertainty			
	Low	Medium	High	Total
Technical	10	5	-	15
Marketing	1	4	1	6
Both (Technical Assistance Agreement)	3	1	-	4
Total	14	10	1	25

Once again the figures are too small for a chi squared test. There is however a clear indication that those firms getting marketing help only have a propensity to introduce new products under licence in conditions of higher marketing uncertainty than do other Type Two licensees.

This whole category of licensee being unexpected, and there being no theory developed to support it, it is not possible to generalize from these results. Further research in this area will be recommended.

Technical Assistance Agreements

Technical assistance agreements are not what the name implies. Much more than technical assistance is generally involved. These agreements allow the licensee complete access to the licensor's cost data, supplier sources, marketing techniques, research and development personnel, and so on. The list is only limited by the initiative of the licensee. Judging by the comments of firms in this sample the licensee is rarely denied access to any information which it really wants to get.

There were only three technology assistance agreements included in the data used in Chapter Five to test hypotheses, in spite of the fact that information was collected on nine. The problem is that in six of the agreements more than one product was involved, meaning that no single answer could be given to questions of level of technical uncertainty, investment required, or stage of product life cycle at which production began, even though only one agreement was involved. Therefore these agreements were withheld from the aggregate data of Chapter Five.

In terms of motive, a few of the firms were looking primarily for marketing help, a few for technical help, but most for both and more.

The motive of most of the firms in technical assistance agreements was expressed in terms of competition. That is, they needed maximum help from the licensor to compete effectively in Canada. A senior vice president of a Canadian firm with sales of more than $100 million which is involved in five technical assistance agreements expressed it this way:

> We compete with subsidiaries operating in Canada in most of our product lines. Their advantages are a good access to new technology, free advertising spillover, and lots of specialists to call on if they need them.
>
> We try to compensate for these advantages by using technical assistance agreements to get the same things. In other words, to compete with subsidiaries we try to make a deal that gives us all the privileges that a subsidiary gets. For this we give up our right to export (which the subsidiary doesn't have either) and pay a royalty. It works.

This manager's remarks are not to be taken lightly. The firm does appear to be competing successfully with subsidiaries operating in Canada. It has apparently done this by replicating the subsidiaries, by competing precisely in kind. At least it has some choice of technology supplier, which the subsidiaries do not.

The observation that licensees in technical assistance agreements are motivated by their competitive situations is supported by market data. Most Type Two licensees do not compete with

subsidiaries. More will be said on this subject in the following section. However, nearly all of those which do compete with subsidiaries are involved in technical assistance agreements. The data are shown below.

Figure 6-7

Type Two Licensees

Competition

Information Received	Competition Includes Foreign Subsidiaries		
	Yes	No	Total
Technical	3	12	15
Marketing	2	4	6
Both (Technical Assistance Agreement)	9	-	9
Total	14	16	30

Combining the data for the first two categories yields a chi squared value of 11.8, which permits rejection of the hypothesis that whether or not a firm competes against subsidiaries is independent of the type of licence entered by the licensee at the .005 level. Further comments on this chi squared test are made in the following section. Every firm in this sample involved in a technical assistance agreement was involved in competition with at least one subsidiary of a multinational firm. This is in sharp contrast to the other Type Two licensees, of which approximately one in four was competing against the subsidiaries of multinational firms.

(c) Product Market Strategy

In nearly every case, the Type Two licensee is restricted to the Canadian market. Faced with this limitation, the licensees have reacted in two distinctly different ways. One group of firms searches

out small markets containing little or no competition and licenses the technology necessary to supply the product for the Canadian market. The second group operates in Canada's major markets, in direct competition with the subsidiaries of multinational firms operating in Canada. These licensees tend to have a lower market share and a more concentrated product line than the companies of the first group. The following paragraphs present evidence to support and expand on the characteristics of the firms of the two groups defined here.

The variable used to identify the firms in each group will be whether or not the firm is producing products under licence which compete in the Canadian market against those of a foreign subsidiary which is manufacturing in Canada. This is considered to be a particularly appropriate variable to concentrate on since the overall problem presented at the beginning of the thesis was phrased in terms of how can the Canadian owned manufacturing firm compete in a domestic environment dominated by the subsidiaries of foreign multinational firms. Here we have two groups of firms, one of which survives by avoiding competition with the multinational firm, and the other which enters direct competition with the multinational firm. The two groups are identified below according to the type of licence being used. These data are a restatement of Figure 6-7.

Figure 6-8

Type Two Licensees

Competition and Licence Type

Competition Includes Foreign Subsidiaries	Regular Licences	Technical Assistance Agreements	Total
YES	5	9	14
NO	16	-	16
Total	21	9	30

The chi squared value for this array, which slightly breaks the rule of thumb presented in Chapter Five, is sufficient to reject the null hypothesis of independence at the .005 level. Given the fact that one of the expected frequencies is just over four, and another is just under five, the chi squared value is probably somewhat inflated. In any case, the chi squared value as presented previously, was 11.8, and that needed for rejection of the null hypothesis at the .05 level is only 3.8. The alternate hypothesis that there is a relationship between whether or not a Type Two licensee's competition and the type of licence it uses is accepted. Type Two licensees competing against foreign subsidiaries in Canada are prone to use a technical assistance agreement. None were used by any licensees not competing against subsidiaries.

A second characteristic to be shown is that firms competing against foreign subsidiaries tend to be in the larger domestic markets. It surely is no surprise to the reader to discover that the larger Canadian markets are those in which the subsidiaries are operating. The data, presented from the point of view of the Canadian licensee, is in the figure below.

Figure 6-9

1973 Domestic Market Size

Competition Includes Foreign Subsidiaries	Market Size in Millions of Dollars			
	0-3.0	3.1-10.0	10.1-200.	Total
YES	4	2	11	17
NO	12	8	3	23
Total	16	10	14	40

The chi squared value for this table is significant at the .005 level, allowing acceptance of the alternate hypothesis that licensees competing

against foreign subsidiaries are competing in larger domestic markets than those which are not competing against such firms.

The next hypothesis may seem apparent as well, and this is that those licensees competing in the larger markets, against the subsidiaries of multinational firms, tend to have a lower market share than those firms which are using a niche filling strategy. The data is presented below.

Figure 6-10

1973 Market Share

Competition Includes Foreign Subsidiaries	0-30%	31-75%	76-100%	Total
YES	10	7	-	17
NO	2	11	11	24
Total	12	18	11	41

Once again the chi squared value is significant at the .005 level allowing acceptance of the alternate hypothesis. Canadian licensees operating in markets where they do not have to compete against foreign subsidiaries tend to have higher market shares.

A final observation, alluded to in Chapter Five, is that most of the Type Two licensees operating in the early stage of the product life cycle are not competing against foreign subsidiaries. The data, which are not sufficient to support a chi squared test, are shown below.

Figure 6-11

Type Two Licensees

Competition and the Product Life Cycle

Competition Includes Foreign Subsidiaries	Product Life Cycle Stage		
	Early	Late	Total
YES	3	4	7
NO	10	6	16
Total	13	10	23

In spite of the lack of statistical significance, the indication is that the majority of firms following the niche strategy are operating early in the product life cycle, while for those competing against foreign subsidiaries there is no clear tendency toward either the early or late stage.

Thus far a statistical picture of the two groups of licensees has been presented. Those firms following the niche strategy, not competing with foreign subsidiaries, are operating in smaller markets, with higher market shares, using standard licence agreements and tend to be in the early stage of the product life cycle. The firms in major markets, those competing against foreign subsidiaries, are in larger markets, with lower market shares, and tend to use technical assistance agreements more often than regular licensing agreements. Some progress was made in discovering why the firms are operating as they are in interviews with senior management. The following quotes are taken from a very senior officer of a major Canadian licensee, one of the largest companies, and most frequent licensees, in the sample. The first refers to competing with the subsidiaries of multinational companies.

> You will discover that most of our competition is Canadian owned firms. If we find that we are competing with a subsidiary we generally back off and try and find a niche in terms of geographical or product specialization. We simply cannot compete with subsidiaries unless special conditions prevail.

This is a very clear statement of the niche strategy and gives a feeling for the attitude of hopelessness of the executives of firms of this type when considering competing against the subsidiaries of multinational companies. When asked with whom his company could compete, the executive stated:

> As a licensee we can only compete against other licensees in Canada, or against imports coming in where the duty payment is roughly equivalent to the licence royalty. To be successful against a subsidiary we need some advantage such as access to cheaper raw materials, cheaper power, political consideration, or cheaper labour, which the subsidiary has not got. This is very seldom the case.

Clearly this company and others like it will be looking for niches in the Canadian market which they can fill by introducing products under licence. A further comment made by the executive with respect to market share is rather interesting.

> To be successful, one of our divisions needs a market share of 25% of the Canadian market. Many

> of them have this. One exception, the ... division, was trying to compete against General Electric. It simply couldn't. We sold it.

It is hoped that enough has been presented on the niche strategy for the reader to gain a feeling for the actions and attitudes of the firms involved. Licensees following this strategy will be referred to again in the final chapter when growth judgments are being made concerning Type Two licensees.

The attitudes and goals of executives of firms competing directly with multinational firms' subsidiaries have already been presented earlier in the chapter in the section on technical assistance agreements. These firms are competing against very difficult competition and are licensing to try and duplicate the advantages which the subsidiary is getting from its parent. Technical assistance agreements are used to permit a closer and more comprehensive relationship with the licensor. The philosophy of these firms seems to be to make themselves as much like the subsidiary of a multinational firm as possible, in order to compete effectively. The contrast in attitude between the managers of the two types of licensee is startling. Firms licensing with a niche strategy do not want to know anything about multinational firms except where they are not; the other group wants to know as much about them as possible, in order to find ways of competing with them. The group of firms competing with the subsidiaries will also be referred to in the last chapter when growth judgments are being made.

(d) Summary - Type Two Licensees

The mass data of Chapter Five indicated that Type Two licensees

are quite a homogeneous group. Nearly all introduce new products under licence in conditions of low technical uncertainty, nearly all face export restrictions and most have made a capital investment of less than $50 thousand to begin production of a new product under licence. The only apparent anomaly, a small group of firms making relatively large initial capital investments, has been explained by their conscious violation of the pure market assumption.

The introduction of market data, however, suggests that Type Two licensees could be usefully thought of as falling into two groups, those which compete with foreign subsidiaries and those which do not. Those which do tend to be operating in larger markets with lower market shares, and have a propensity toward using technical assistance agreements. It is primarily in this category that firms are found viewing licensing as a transition stage, a vehicle to make it easier for them to develop an in-house research and development competence. More will be said on this subject in Chapter Seven.

The second group of firms, those not competing with foreign subsidiaries, tend to be operating in smaller markets with higher market shares. Although quantitative data were not presented to support this contention, these firms seem to be producing a wider range of products than do those of the first group.

Although the data base for Type Two licensees is larger than that for Type One, many of the observations in this section should be considered as tentative.

3. Type Three Licensees

As with Type One and Type Two licensees, the data presented in Chapter Five concerning Type Three licensees are summarized below.

1. By definition, all Type Three licensees have a relatively low research and development competence, with less than 3.5% of total employees consisting of qualified scientists and engineers. In addition, all Type Three licensees are in licence agreements involving a one time technology transfer.
2. Type Three licensees introduce products under licence at all levels of technical uncertainty with approximately equal frequency, although there is perhaps a slight bias toward the low technical uncertainty category. Of the 12 Type Three licensees, 5 indicated products were introduced in conditions of low technical uncertainty, 4 in conditions of medium technical uncertainty, and 3 in conditions of high technical uncertainty.

3. Most Type Three licensees (7 of 12) made an initial capital investment between $51 thousand and $499 thousand to produce a product under licence. Of the remaining 5 licensees, 3 spent less than this amount, and 2 more than this amount.
4. Ten of the 12 licensees began production at the beginning of the Canadian product life cycle.
5. Five Type Three licensees began producing a product within 3 years of its world introduction, 4 began between 4 and 10 years after the world introduction, and 3 began between 11 and 30 years after the world introduction.
6. Exports were allowed in 9 of the 12 (75%) licence agreements.

As with Type One and Type Two licensees, these observations are examined for results not predicted by the research model. In this case the only real surprise is that three of twelve products introduced under

licence were done so in conditions of high technical uncertainty. No satisfactory explanation was found for this other than that the operational definition of research and development competence may again be misleading. All three products were introduced by the same firm. In fact by the same division. When asked how the division could operate in areas of high technical uncertainty when less than 1% of its employees were qualified scientists or engineers, the managers replied that it was not the engineers that are important in their business, it is the technicians. This may be so. At any rate no other explanation for this surprising data can be offered.

(a) Licensing Motive

The Type Three licensees are a more homogeneous group than either of the other two types. All have relatively low in-house research and development capability, and all except one entered licence agreements involving a transfer of technical know how. None of the firms were primarily interested in gaining marketing knowledge through their licence agreements, and none of the agreements were in the form of technical assistance agreements.

The motive of all of these licensees was to begin production of a new product with initial help from the licensor, and then make any further modifications, which they anticipated would be few, themselves. Approximately half of the licences in this category were held by firms which had a general competence in a particular process area, and needed the design of products which could be made using this process. Employing the niche strategy previously discussed these licensees would search out untapped Canadian markets, license the product technology needed, and begin to produce for these markets, using their well

established process.

Most Type Three licensees do not compete with foreign subsidiaries (nine out of twelve) and those which do have a sharply lower market share (28% on average), than those which do not (68% on average).

There is a message for all licensees in the experience of one Type Three licensee which originally intended to license on a continuing basis, but was forced to revise its intentions as the licensor approached bankruptcy. This same licensee had an agreement with a second licensor, which it also hoped would involve a continuing transfer of technology, but found that the licensor stopped development work once the licence agreement was signed. It is obviously critical that the licensee make a thorough size up of the licensor before entering a licence agreement, particularly if it is to be a continuing agreement.

Summary - Licensing Motives and Conditions

This chapter has revealed that firms of each licensee type do not necessarily share the same motive for licensing, and that the motives for licensing do in some cases have a bearing on the conditions under which firms license. The following paragraphs briefly review the situation for each of the licensee types.

Type One licensees license freely under conditions of high, medium, or low technical uncertainty, license products relatively early in their life cycle, do not avoid investing substantial amounts to produce products under licence, and do not face export restrictions. One variance in this latter condition is observed when these licensees are separated according to licensing. Those firms licensing to gain patent rights only do not face export restrictions at all, while those which license to gain know how as well do increasingly face export restrictions as the know how

contest increases. Thus the motive of the licensee determines the information transferred from licensor to licensee, and this in turn determines the conditions under which the licence is offered.

For Type Two licensees this observation is also valid. The three motives identified were licensing to gain technical information, to gain marketing information, and to use technical assistance agreements to gain both and more. Firms using ordinary licence agreements to gain technical information tended to be those competing in domestic market niches, small markets of which they held a high market share. The motive was to gain the technology necessary to exploit the Canadian market. The licensees licensing to gain marketing information tended to produce a higher proportion of consumer products, in conditions of higher marketing uncertainty than other Type Two licensees. Finally, the firms using technical assistance agreements were competing against multinational firms operating in Canada, and their motive was to gain enough information of all types, not just technical information, to compete successfully against these firms. In these cases a circular process exists in which the firm's competitive situation determines its licensing motive, which in turn determines the type of agreement entered, and thus the restrictions placed on the licensee. These conditions directly affect the firm's competitive situation. These differences between Type Two licensees should not obscure their similarities. All were licensing to obtain a continuing flow of information from the licensor, to avoid the necessity of developing in-house skills. This common motive led to common conditions under which licensing took place; low technical uncertainty, products which had been on world markets a relatively long time, and a very high incidence of licensing restrictions.

Type Three licensees have in common the desire for a one time transfer of technology, which generally leads them to licensing in conditions of medium technical uncertainty, making neither relatively high nor low investments, and producing products older than those introduced by Type One licensees, but younger than those of Type Two.

The importance of the sub groups identified in this chapter is that growth judgments will be made for each of them, based on the general characteristics established in Chapter Five and the characteristics specific to each sub group presented in this chapter. The data on which the growth judgments will be made have now all been presented. The final chapter deals with issues of evaluation and judgment and in only one case, the presentation of an hypothesis important for further research, are new data presented.

Chapter Six

Footnotes

1. For details of a statistical test used to test the hypothesis that the means of two populations are equal, working from small samples, see Y. Chou, Statistical Analysis, (New York, Holt, Reinhart and Winston, Inc., 1969), p. 389.

Chapter Seven

Where as Chapters Five and Six have featured the presentation of facts, this one features judgments concerning the significance and implications of those facts. In Chapter One justification for a study of licensing in Canada was given. Now that the study has been done the researcher must support the original contention that the study is significant by indicating to whom its conclusions are significant, and why. Before this can be done, there must be conclusions.

The first task is to come to a conclusion regarding the growth issue. This will be done separately for each of the three licensee types. The research has demonstrated that there are significant differences in the conditions under which the different types of licensee license, as well as between their attitudes and actions, and these result in different conclusions with respect to the viability of licensing as a growth strategy.

Also presented in this chapter are a new model and new hypotheses, suggested for future research, which are stated together with the observations that lead to their formulation. This model is the result of examining quite closely the activities of four firms. The small sample is definitely not statistically significant, and further research into the area would have to be on an in depth, non statistical basis.

The final portion of the chapter presents concisely the overall conclusions of the research, followed by the implications for business and government and suggestions for future research.

1. The Growth Issue

No one can accurately predict the future growth of a new

product either in aggregate, for an industry, or at the level of the single firm. Projected growth rates for 1974, 1975, or any other year are not the issue here. The question under consideration is the general one of whether or not licensing is a strategy offering a firm good growth potential. At any given point in time some products have already matured and others are just beginning their life cycle. It is senseless to try and compare their growth rates for any given year. The position taken here is that the question of growth potential is truly a judgment - no impressive but inevitably unrealistic formula will be presented purporting to separate those products which have growth potential from those which do not. In this case the critical judgment is being made by the researcher, but it is hoped that enough evidence has been presented for the reader to evaluate this judgment for himself, and come to his own conclusions regarding its soundness.

(a) Type One Licensees

In Chapter Six close examination revealed that several productive units which although meeting the operational definition of research and development competence, did not in fact possess such competence. The growth potential of these licensees is considered more appropriately with that of the Type Two licensee.

Type One licensees receiving patent rights only from licensors do not have any restrictions placed on them by their licensors either in terms of export limitations or purchasing obligations. No artificial barriers to growth are erected. On the other hand, the licensee in such a situation is not learning anything from the licensor. The core skills of the licensee are not changing. No new growth area is being offered by the licensor. The growth potential of the licensing option in this

situation is completely in the hands of the licensee. It is the licensee which decides what product to produce, and it is free to market it where ever it wishes. Licensing is an asset to such a firm because it reduces risk (and possibly cost) during the development of the product. Other than that, it has no real effect on the firm's growth potential.

Type One licensees receiving technical know how and patent rights on a one time basis under licence are not in such a free position as the licensees described above. In the sample chosen for this research half of the agreements of this type contained export restrictions. However in this case the licensee is learning something from the licensor and is moving into a new product area, for which it did not do the development work itself. This new product is likely to have some growth potential since the Type One licensee will almost certainly be the first in Canada with the new product, and generally will not lag far behind the product's world introduction. Because of their research and development competence such licensees can develop the product as they see fit, making modifications necessary to suit the Canadian market, once the initial transfer of technology has taken place. For these reasons the growth potential of products produced under licence in such situations is considered to be good. A critical factor of course is the choice of product made by the licensee, but this is always the case, whether the product is to be developed in-house or produced under licence. In making comparative growth judgments between different licensing situations the judgment shown by the licensee in choosing a product will be considered to be a constant.

Special mention should be made of the transfers of very new technology which can be used to generate a variety of end products.

Two such agreements were presented in Chapter Six. It is felt that the growth potential for the Canadian licensee in these situations is very great. Even if export restrictions apply to the product being produced from the technology at the time the transfer of technology takes place (as they did in one of the situations) other products developed from the technology can be exported.

(b) Type Two Licensees

In 80% of the continuing transfer licence agreements entered by firms with low in-house research and development competence, the licensees were restricted to selling products made under licence in the Canadian market. The firms have two quite different ways of coping with this restriction. One group tries to fill market niches existing in Canada where it can operate without encountering any serious competition. Firms of this group generally obtain a large market share of a small market, and then do the same with another product. The end result of this process is that the firm produces a wide variety of specialized products under licence, each to fill a small niche in the Canadian market. The second group of firms does something quite different. These firms enter a major Canadian market, generally in competition with foreign subsidiaries, and settle for a small share of the large market.

In terms of growth potential, both categories of firm are in a poor position. Both are heavily dependent upon the licensor for changes in technology, and in only about half the cases are the firms first on the Canadian market with the product, generally far behind the world introduction of the product. One group is continually looking for small overlooked markets worth exploiting, while the other has the

unenviable task of competing head to head with foreign subsidiaries while having no in-house research and development capability of its own.

If this were the whole story, the option of licensing instead of doing in-house research and development, which is what these firms are doing, would have to be discarded as a viable growth strategy. These firms are not well placed for growth. However there are four firms which are licensing with a difference. This difference is not reflected in an external assessment such as that just made, because the difference is internal, a matter of attitudes and goals. Licensing is not considered an end in these firms, but rather a means of achieving a corporate goal. This goal is the development of an in-house research and development competence.

This concept of using licensing as a vehicle for the development of in-house research and development skills will be discussed in depth in the section on the licensing cycle. The existence of such a cycle is the one hope for growth for firms which are licensing instead of doing their own research and development. If they can use the continuing transfer licence agreement as a means of developing an in-house research and development competence the licensing strategy offers some hope of growth for these firms. Otherwise it does not.

(c) Type Three Licensees

Type Three licensees are those which have a low in-house research and development competence, but do not rely on the licensor as a continuing source of new technology. The argument made in the research model that such firms are operating in an industry where changing technology is not a critical factor in competition is supported by the fact that the hypotheses built on the argument were supported, and by observations made by the researcher during the data collection,

although no quantitative measure was made. Products produced by licensees in this category included steel pipe, furniture, toilet partitions, and filing cabinets, to name a few. All of these products have been produced in their present form for a large number of years, although not necessarily by the licensee.

In these industries new products are rare, and as likely to come from outside the industry as within it, thus it makes sense for these firms to license these new developments as they become available. They do not have an in-house research and development competence and neither do their competitors. Most of the products produced by these firms under licence are the first of their kind on the Canadian market. In addition, most of the licence agreements entered by these licensees do not contain export restrictions. Licensing technology to produce new products is judged to be a reasonable strategy for firms of this type.

2. The Licensing Cycle

The activities of four licensees, currently involved in twelve licence agreements, have lead the researcher to create a model and a series of hypotheses based on the observation that the firms are moving (or have moved) through a cycle which takes them from being totally dependent on the licensor for all new technology through to the development of an in-house research and development capability. If such a process, here labelled the licensing cycle, could be generalized and the steps in it more positively identified, it could prove extremely important to Canadian industry.

Three of the four firms are Type Two licensees, and are currently moving through the cycle. The fourth firm, now a Type One

licensee, has already completed the cycle. A tentative model of the process through which these firms are moving is presented below, followed by three specific hypotheses and the observations that lead to their formulation. The hypotheses are the basis of the model; the observations the basis for the hypotheses. Based on a sample of only four firms, the model must be regarded as speculative.

Figure 7-1

The Licensing Cycle

Stage One: The Canadian owned firm, with a low research and development competence, is competing against foreign subsidiaries in Canada in markets in which technical change is important.

Stage Two: Unable to compete effectively because of its lack of new technology, the Canadian firm enters a licence agreement involving a continuing transfer of technology with a large foreign company. This is more often than not a technical assistance agreement.

Stage Three: As the licensee's sales volume grows, it experiences frustration with the licence agreement and begins to develop its own technical capability, learning skills from the licensor. Over time, dependence on the licensor is lessened.

Stage Four: The licensee develops enough of an in-house research and development competence to cancel or renegotiate the licence agreement. Stage Four could take place as long as ten or fifteen years after Stage Two.

The following sections present the hypotheses and observations on which this four stage model is based.

Hypothesis A

Firms which manufacture products under licence agreements providing for a continuing technology transfer have an opportunity to develop an in-house research and development competence in the area of technology which is being supplied by the licensor at lower risk than if they were to develop the in-house competence without entering a licence agreement.

This hypothesis is concerned with the motivation of firms moving through the licensing cycle. The risk referred to in this hypothesis is financial, technical and marketing. If a firm is to develop an in-house research and development capability it will have to spend a large sum of money to hire scientists and engineers and the support staff and equipment they require, as well as pay the variable costs of developing new products. It could easily be a number of years before the product is actually put on the market, if indeed it ever reaches that stage, and even then it may prove to be unsaleable. The risks to a relatively small firm (such as the majority of Canadian owned manufacturing firms) of going through such a process are very great. These are the factors suspected by this researcher to be preventing Canadian owned manufacturing firms from developing in-house research and development competence.

Licensing can reduce these risks, according to the managers of firms going through the licensing cycle. A licence agreement on a continuing basis allows the licensee to gradually build its in-house competence, learning all the while from the licensor. According to

one executive this technical competence building must begin even as the licence is signed.

> To start with, I would say that using a licence agreement strengthens a firm's technical capability. I realize that most people think the opposite, but its simply not true. We must have the technical competence to receive, translate, and make use of the incoming technology. In most cases this is more competence than we have at the outset, so we must increase our technical capability simply to make use of the licence.

This same executive considered the key to further development of the licensee's technical competence to be the increase in volume of a product produced under licence. As this volume rises it becomes more economical for the licensee to carry out activities in-house. To quote him once again:

> As product volume rises we will import fewer components from the licensor and begin to manufacture them ourselves. We will also begin to make design modifications so that the product will better suit the Canadian market. Finally, it may become worth our while to make process modifications once volume becomes substantial.

At the same time as the firm is gaining technical competence it is also learning the market for the product line, reducing the probability that it would eventually develop a new product which would not

sell. Thus the technical risk is reduced because of the learning which takes place from the licensor over a period of years, the marketing risk is reduced through knowledge gained when the product is produced under licence, and the financial investment is spread over a number of years and can be discontinued at an early stage if the product area does not seem fruitful. These firms do not expect this process to take place overnight. The president of a firm in the early stages of the licensing cycle stated:

> I hope that by the end of the 15 year agreement that we will be technically self sufficient. However, if we are not, we will simply renew the licence agreement and keep progressing.

The discussion thus far has concentrated on the risk reduction portion of the hypothesis. A second issue included in the hypothesis is that of frustration. Firms do not only move through the licensing cycle for positive reasons. As suggested by Stage Three of the model firms are motivated to reduce the frustration caused by the agreement.

In only one of the four licensing cycle firms was the objective of establishing an in-house research and development competence completely specified even before the licence agreements were entered. This firm considered licensing as simply a means of attaining the goal of technical competence at minimum risk. The other three firms experienced difficulties once they had entered agreements which motivated them to develop their own skills in order to reduce their dependence on the licensor. The following quotes from the executives of the licensees indicate the nature of the difficulties involved. From the vice president of a small

firm:

> Our U.S. licensor makes the "Cadillac" in the product line we manufacture under licence. It is a very high quality product, over engineered and over built. For a year or two we made some progress with their designs, but then we just could not sell them. They were so expensive to build that we could not bid low enough to win any contracts. As a result we are gradually building up our own design team, and have hired away one of the licensor's top designers. Now the licence agreement is being modified to cover fewer items and we are designing more ourselves. This process will continue.

The Type One licensing cycle firm identified in Chapter Six began its own development work in large part because royalty payments became very high in absolute terms as the volume of product produced under licence grew. There were other reasons as well. The licensee was unhappy with the slow pace of technological development undertaken by one licensor. In a second situation the licensor decided to curtail the agreement after 18 months. This was a prearranged agreement which forced the licensee to begin establishing its own development capability even while the agreement was in effect.

The importance of these observations with respect to motive is that three of the four firms did not enter licence agreements intending to go through the licensing cycle. They had not ahead of time considered

licensing as a relatively low risk method of developing an in-house research and development capability. Only now that it is happening or has happened are they realizing the full benefit of what they are doing. There seems to be a very great need for education of firms with respect to the possibilities licensing has for putting a firm on the path to developing in-house research and development competence. This thesis is the first step in publicizing this option. Further research on the licensing cycle may lead to further publicity.

Hypothesis B

Licensees with continuing licence agreements most likely to move through the licensing cycle are those competing with the subsidiaries of foreign multinational firms operating in Canada.

This hypothesis is embodied in Stage One of the model. As demonstrated in Chapter Six the Type Two licensees competing against foreign subsidiaries in Canada tend to be in larger markets, with smaller market shares, and using a higher proportion of technical assistance agreements than other Type Two licensees. Although it was not verified quantitatively, it was indicated by the researcher that the firms competing with multinational subsidiaries tend to have fewer product lines, and as a result, each product area is more important to the firm. It is postulated that such firms will be more likely to go through the licensing cycle because the nature of their competition demands it. They are competing against competitors who, for the most part, have access to research and development laboratories, and the shortcomings of a licence agreement, as just outlined for several firms, become critical.

The licensees following the niche strategy are not subject to the same competitive pressures, and are involved in a greater variety of

products, each one being of less than critical importance to the overall health of the firm. For this reason these firms do not feel the same pressures for developing in-house research and development competence as do licensees competing with foreign subsidiaries, and are postulated less likely to go through the licensing cycle.

Of the twelve licence agreements currently held by licensing cycle firms, eleven are used to produce products which compete on the Canadian market with those produced in Canada by foreign subsidiaries.

Hypothesis C

Licensees with continuing transfer licence agreements most likely to move through the licensing cycle are those making a deliberate effort to establish a close relationship with the licensor.

It is argued that in order to learn from the licensor, which is a critical process in the licensing cycle, the licensee must establish a close relationship with the licensor. This will be a deliberate violation of the pure market assumption. As already pointed out in Chapter Six, most Type Two licensees competing with foreign subsidiaries used technical assistance agreements, allowing a more complete access to the licensor. This is not a chance occurrence.

Of the eight licence agreements currently held by Type Two licensees going through the licensing cycle, seven are technical acquisition agreements. Of the four held by the firm which has completed the cycle, three are cross licensing agreements. This is as would be expected from the licensing cycle model.

A last comment is necessary before this section on the licensing cycle is complete. This was referred to in Stage Four of the model. It is by no means easy or instantly profitable for a firm to move through

the licensing cycle. It may be a less risky way of acquiring technical skills, but it is not risk free. The following comments were made to a University of Western Ontario researcher by the president of the one company in the sample which has completed the licensing cycle.[1]

> We had a lot of second thoughts over the years about the viability of building our own technological strength. At the time, in the late 1950's, our sales were about the same as those of a competitor obtaining its technology from a U.S. licensor. In 1958 for example both firms had sales of about 15 million dollars, but their profits were around $1,000,000 and ours were about $250,000. This imbalance between profits and sales lasted at least 10 years. By 1968 their sales had jumped to 29.4 million with profits of $1.2 million, while our sales were 35.6 million with profits of $850,000. It was not until 1972 that things really began to break in our favour and our long years of in-house technological development began to pay off. In 1972 the competitor's sales were $37.7 million with profits of $790,000 while we had sales of $88 million and profits of $4.5 million.

The difficulty with an analysis of this type is that the profit and sales figures may or may not reflect the method of technology acquisition. In this case the president felt that they did.

Summary - The Licensing Cycle

The licensing cycle is a real phenomenon, attested to by the fact that one company has already completed it, and others are consciously moving through it. What is not certain is if it is of general applicability. Can any firm move through the cycle, or do these four have some special characteristic which makes the cycle feasible for them, whereas it would not be for others? On the surface, this does not seem to be the case, but in depth research is needed. The existence of the licensing cycle could prove very important in a country where few firms

independently develop a research and development competence.

3. Conclusions

The findings concerning the conditions under which licensing takes place, summarized in Chapter Six, will not be reiterated as conclusions of the research. The conclusions will be restricted to two areas, the judgments made of licensing as a growth strategy and the appropriateness of the theory on which the research model was constructed.

(a) Growth

The most important conclusion of this research is that the manufacture of products under licence agreements providing a continuing flow of technology by firms with a low in-house research and development competence is not a strategy with good growth potential except in as much as it may lead the firm to develop its own in-house research and development competence. This conclusion is considered of primary importance because the majority of Canadian owned manufacturing firms are not competent at research and development, and a major goal of the research was to evaluate licensing as an alternative to the development of in-house research and development skills. The conclusion is that licensing when used as an alternative to the establishment of in-house research and development competence does not provide a firm with good growth potential.

The second growth conclusion refers to Type One and Type Three licensees. These are the firms which have research skills appropriate to their environment, as demonstrated by the fact that they do not rely on the licensor for a continuing transfer of technology. Licensing is a reasonable growth strategy for these firms. In those situations in

which a whole new technology was being transferred to the licensee, rather than just the information necessary to make a specific product, the growth potential for the licensee was judged to be very high.

(b) Theory

The research model was built in large part on interpretations made by this researcher of work done by Harold Crookell and Len Wrigley. Conclusions regarding this work and the soundness of the interpretations made of it are presented below.

Crookell's thesis depicted the problem of the Canadian owned firm as being unable to begin production early in the product life cycle. The present researcher made the assumption that what was true for the one industry studied by Crookell would be generally true for all industries. This was a false assumption. It has been shown that, at least for products made under licence, the Canadian owned firm is usually the first in Canada with the product. Further examination has shown that there are two quite different strategies followed by Canadian licensees. Firms using the "niche" strategy avoid competing with foreign subsidiaries and will often be first in Canada with the new product. Crookell's study clearly did not include firms of this type. His sample was of firms following the other strategy, that of competing in Canada's major markets in competition with foreign subsidiaries. Most firms in the present sample did not compete against foreign subsidiaries, leading to the overall result that most licensees are first in Canada with products produced under licence. What is sorely needed is a research effort aimed directly at studying the nature of competition between Canadian owned and foreign manufacturing firms in Canada. This study suffers because it deals only with licensees, and Crookell's

because it considers only one industry. This will be referred to again in the section dealing with suggestions for further research.

Wrigley's model dealing with the integration of research and development with production proved to be absolutely central to a study of licensing. The situation depicted in the model is extreme, with a "pure" market and no technical skills in the production unit, but the model when interpreted from a core skills point of view and combined with the other parts of the research model lead to uncertainty and risk hypotheses which were supported. In fact both of the positions in the model judged to be extreme turned out to be important variables. The pure market assumption was a situation firms were working actively to avoid, their goal was to make the relationship with the licensor more than a market relationship. The other key factor, of technical competence on the part of the licensee was a critical variable in establishing the three licensee types, and was considered important by the firms themselves in terms of selecting, receiving and absorbing technology. The Wrigley model, with respect to the present research, proved a valid predictor of situations in which licensing is used, and the model accurately pinpoints the variables which proved important to the firms.

4. Implications

A thesis, by its very nature, takes a narrowly defined problem and examines it in considerable depth. This one is no exception. In considering the implications of a thesis it is appropriate to examine the effects of the necessarily narrow conclusions on the wider environment. In this case the wider environment includes the competitive position of the Canadian owned firm, its options for improving its

performance, and the role which government can play in creating new options or improving existing ones.

Generally speaking, the Canadian owned secondary manufacturing firm has not been competing well against the foreign owned subsidiary in Canada. Canada has the highest level of foreign ownership of any advanced nation in the world,[2] and this will continue to increase unless the domestically owned firms can at least match the growth rate of the foreign subsidiaries operating in Canada. Data are available to show that during the 1960's domestic firms had a lower rate of growth than foreign firms in Canada, and were less profitable in terms of return on assets and sales.[3] Canadian owned firms need strategies for growth. At present it seems that nearly all of their energies are consumed merely for survival.

Any diagnosis with the objective of determining the reasons for the poor performance of Canadian owned secondary manufacturing firms immediately unearths the fact that innovative effort, as measured by output in terms of new innovation,[4] or by input in terms of R&D spending, is very low. Data illustrating the low level of R&D spending were given in Chapter One. The importance of this fact is not indisputably established, but suspected by this researcher and others to be one of the root causes of the poor performance of Canadian owned firms.[5] Certainly a wide variety of studies have been carried out linking R&D effort and subsequent corporate performance.[6]

This line of reasoning pinpoints the importance of the licensing option. If licensing could be used by firms with a low research and development competence as a continuing source of technology, then licensing could be an important method of improving the competitiveness

of Canadian owned firms. This leads to the major implication of this research. Licensing cannot be used in this way. The growth potential of firms with low in-house research and development skills securing technology on a continuing basis is poor. Licensing is not, in itself, a solution for the Canadian owned firm. Other options must be considered.

Given the assumptions and arguments just presented, first and foremost among these options must be the development of in-house research and development competence by Canadian owned manufacturing firms. The implications of this research in this regard are several. For businessmen with relatively small non licensing firms who have the goal of establishing an in-house research and development competence, the findings of this research of greatest interest are those relating to the licensing cycle. The experience of firms moving through this cycle and the argument that it is a lower risk method of developing the desired competence are very relevant to such businessmen. Executives in this position should consider searching out a licensor in the desired technical area and building up in-house skills over time. This route for obtaining in-house research and development skills has not, to the best of this researcher's knowledge, ever been publically documented before.

For firms with low in-house research and development skills which are obtaining technology under licence on a continuing basis, the major implication of this research is that this should be treated only as a transition stage. Firms should not remain as Type Two licensees, having no in-depth technical skills relating to the products they are manufacturing and selling. For licensees operating in competition with foreign subsidiaries in major Candian markets the recommendation is that very close ties be formed with the licensor in order to permit better

understanding of technology in the short run, with the objective of moving through the licensing cycle in the longer run. Resources need to be committed to the gradual establishment of an in-house research and development competence.

For such licensees not competing with foreign subsidiaries, which is to say those operating in small Canadian markets, the route to growth in the past has been to find more and more such markets. This leads to a very wide product line, and the licensee has very little technical competence relating to any of the products. For these firms the recommendation is to over time make a strategic product choice. Focus attention on a few of the products and begin to establish closer ties with these licensors and begin to make an investment in developing a research and development competence in these areas. Phase out the more marginal products in order that resources can be concentrated on the chosen products. If the firm can move through the product life cycle it will in the end be free to export and can cross license for patent rights it needs. The process will not be easy, but in this researcher's judgment the long term growth potential is significantly greater than that of the present strategy of looking for small markets, unexploited, but which will never become large markets.

The preceding are the implications of the research for firms wishing to develop an in-house research and development competence. For government, the implication of the research is that the Gray Report was incorrect in suggesting that licensing is a viable solution for the Canadian owned firm. Once again the government should consider programs to encourage domestic firms to carry out research and development. The level of innovative performance in Canada must be improved.

A further implication of the research for government relates to the restrictions on licence agreements. As indicated earlier, government has expressed the intention of reviewing licence agreements entered by Canadian firms with the intention of lessening the restrictions which they place on the domestic firm. The findings of this study suggest that the incidence of procurement restrictions is very low, and while action could be taken by the government in this area, it would not be particularly meaningful. With respect to export restrictions the situation is much more complex. The data presented in Chapter One suggest that many licensees with export rights do not take advantage of them. Interviews with licensing executives confirmed these data. Only a handful do any significant exporting.

If the government were to take action to prohibit licensing agreements from being signed by Canadian firms which contain export restrictions, two results are predicted. One is that the propensity of Canadian firms to export would not increase. The other is that licensors would not be willing to enter licence agreements involving the continuing transfer of technology if they did not contain export restrictions. In this situation the licensor would have little to gain and much to lose. In signing the agreement it is creating a potential competitor, to which it is obliged to supply its latest technological advances. Given the previous judgment that licensees with continuing transfer agreements do not have good growth potential, it may seem at first glance that it would not matter if such licences were no longer possible. This, however, is false. Such continuous licence agreements are a necessary transition stage for firms moving through the licensing cycle, and they should not be denied the opportunity of doing this.

The recommendation, pending further research on the licensing cycle and exporting practice, is that the government not prohibit export restrictions in licence agreements entered into by Canadian firms.

These are the major implications of this research, for both business and government. The implications of some of the examples presented in Chapter Six are, it is hoped, self-evident. For instance, government purchasing policies are extremely important to Canadian owned firms. Also, for a small firm developing research skills it makes sense to concentrate in a very narrow area and then use cross licensing agreements to trade the resulting patents for rights to manufacture in other areas.

5. Suggestions for Further Research

This research project leads to two general areas of further research. One is concerned with further research to do with licensing, and the other with further research designed to consider other possible growth options open to the Canadian owned manufacturing firm.

(a) Licensing

The major suggestion is for further research into the licensing cycle. This could prove to be of major significance to many Canadian companies and the government if it proved a viable route for firms to acquire an in-house research and development competence. The research would have to be an in-depth examination of a few firms, and the steps and hurdles in the cycle determined. If possible it would be useful to delineate further the characteristics of firms for which the licensing cycle is an appropriate strategy as well as those for which it is not. The search for firms going through the cycle should be widened to include primary manufacturing firms.

Two other research studies could be done which would complement the current research. One would concern licensors. Why do some firms, such as RCA, freely license new technology, while other firms will not license at all? What type of technology can a licensee expect to be offered in a licence agreement? What are the elements in the licensor's decision to grant a licence? What options are open to the licensor and how are these changing? A research project to answer these questions could both make use of and support the current research. The other beneficial area of research would be a study parallel to this one in a country in a similar position to Canada, perhaps Australia. Some of the data in this research, especially in Chapter Six, suffer from too small sample sizes. A corroborating study would be most useful, and could draw on the concepts developed here.

A final interesting area of licensing research would be to consider licensing as it relates to the marketing dimension of a firm's core skills. This would require a measure of in-house marketing competence, as well as concentration on marketing uncertainty and marketing economies of scale. As stated previously six licensees indicated that they were receiving only marketing information from the licensor on a continuing basis. This is not a large sample. However, the marketing element was also of interest to other licensees. For instance, a sharp dichotomy in licensees' attitudes toward using the licensors' names on products produced under licence was observed. Some considered it to be highly advantageous, while others would not even enter agreements which required it, asking why they should build a Canadian market for the licensor's brand name. The fear was that the licensor would take over the market once the licence expired.

(b) The Canadian Owned Firm

As mentioned earlier, further research is needed into the nature of competition between Canadian and foreign owned firms in Canada. The current research, dealing only with licensees, has identified two strategies in use by Canadian owned firms. Crookell's thesis was a comparative study, in that it dealt with both foreign and domestic firms, but was restricted to one industry. A study is needed which takes as its central thrust the determination of the nature of competition between foreign and indigenous firms, perhaps comparing the situation in the secondary manufacturing industry with that in the primary manufacturing industry. Such a study could result in major recommendations concerning the competitive strategies of Canadian owned firms, and would be very useful in identifying areas needing further research.

The major issue of which this thesis is but one part is, how can indigenous Canadian manufacturing firms successfully compete in a domestic environment dominated by the subsidiaries of foreign multinational firms. This thesis has examined only one possible solution for the Canadian owned firm. As this solution seems to offer little growth potential to firms without an in-house research and development already in place, further research should concentrate on other possible solutions open to the Canadian owned firm. One potential growth strategy for the Canadian owned firm would be to improve the penetration of foreign markets. As stated earlier, the export performance of Canadian owned secondary manufacturing firms is poor. In addition, few of these firms have plants abroad. Research to determine the steps and hurdles which a firm must go through to move from being a non exporter, to a minor

exporter, then a major exporter, and finally to making a direct foreign investment would be very useful.

Finally, many of the competitive problems of the Canadian owned secondary manufacturing firm have been blamed on its relatively small size. Further research is needed to determine precisely what limitations small size does impose on a firm's choice of competitive strategies. A closely related topic is the government induced merger of domestic firms as a response to foreign investment. This solution has been carried out in Britain in several industries, with apparently mixed success. The formation of such large firms as a response to foreign investment was recommended by Servan Schreiber in The American Challenge.[7] Closer to home, the same recommendation was made in Volume Two of A Science Policy for Canada.

> As it now stands the Canadian private environment is rather unconducive to industrial innovations. To make it favourable, the secondary manufacturing sector will have to undergo a major conversion. Most industries are composed of too many small firms and of businesses that have not rationalized their operations and developed maximum efficiency. As a result, their R&D effort is usually weak and inefficient.[8]

In this case the assumption is that a firm must be large in order to carry out a strong and effective research and development program. Research into government induced mergers and the whole issue of size as a factor in competition is needed very greatly.

Summary

The thesis is now complete. This chapter has presented the judgments concerning licensing as a growth strategy. These are that licensing is not an option providing good growth potential for firms receiving technology from the licensor on a continuing basis. The continuing technology flow licensing strategy for firms with low research and development skills is only superficially attractive. The authors of the Gray Report were misled by this surface attractiveness. The reality is that there is an unhealthy degree of dependence upon the licensor, and a very high incidence of export restrictions. Licensing of this type is only beneficial to firms which are using it as a means to an end, that end being the establishment of an in-house research and development competence.

The major implication of the conclusions is that the search for a viable growth strategy for the Canadian owned firm must continue. Use of the licensing cycle as a means of developing an in-house research and development competence may be a viable solution, but more research is needed before this can be stated with confidence. Other potential solutions needing further research are the penetration of foreign markets by Canadian owned manufacturing firms and the artificial creation of size via merger.

Chapter Seven

Footnotes

1. This passage is taken from notes made by Harold Crookell in 1974 during an interview conducted in order to gather case material.
2. Gray, p. 1.
3. For sales growth figures see Corporation and Labour Return Act: Part One, Corporations, (Ottawa, Statistics Canada, 1963-1969). For profitability figures see Gray, Table 5, p. 25, indicating the foreign share of profits is higher than that of sales or assets.
4. For an analysis of new innovation, in which Canada ranks consistently near the bottom, see Gaps in Technology Between Member Countries: Analytical Report, (Paris, OECD, 1969), Volume 2.
5. See Footnote 9, Chapter One.
6. One of the most comprehensive and most recent of these is W.N. Leonard, "Research and Development in Industrial Growth", Journal of Political Economy, March-April 1971, p. 232.
7. J.T. Servan Schreiber, The American Challenge, (New York, Atheneum, 1969) p.p. 153-162.
8. Senate Special Committee on Science Policy, A Science Policy for Canada, (Ottawa, Information Canada, 1972), pp. 601-602.

APPENDIX

LICENCE AGREEMENT CLAUSES

taken from

STANDARD CLAUSES IN A LICENCE AGREEMENT

by

Kenneth Mason

This agreement made the day of 19
between
a company incorporated with limited liability in
and having its registered office at
in the county of country
(hereinafter called the licensor) of the one part and

a company incorporated in
and having its registered office at
in the county of country
(hereinafter called the licensee) of the other part
RECITALS
Whereas the licensor possesses a substantial secret property, knowledge of a specialised nature concerning the manufacture of (product) the subject matter of this licence
Whereas the licensor is the registered proprietor of letters patent set out in schedule A and has the right of disposal of the said patents
Whereas the licensor has applied for letters patent set out in schedule B
Whereas the licensor is the owner of (a) trademark(s) and trade names listed in schedule C hereto under which products to be licensed have been customarily sold or licensed
Whereas the aforementioned patents and know-how have already been the subject of exploitation, the licensor having manufactured (product)
Whereas no licence in respect of these patents patent applications know-how or trademarks has yet been granted by the licensor

Whereas the licensee is engaged in the business of making and selling (his products) and wishes to make use and sell (product) hereinafter called the licensed product in the territory defined in clause 1 and to obtain technical assistance and a licence from the licensor so to do
Whereas descriptive headings to the clauses in this agreement are inserted for convenience only and shall not control or affect the meaning or construction of the said clauses
It is hereby agreed by and between the parties hereto as follows:

CLAUSE 1 - Definition of terms
The following definitions are hereby agreed to for the purposes of this agreement:
'Advertisement' shall include the preparation and publication of sales literature, advertisements in journals, mailings of literature, samples and other promotional activity
'The date of royalty' shall be the date of shipment of the goods or the date of the invoice to the customer, whichever is the earlier
'Development term' shall mean the period of years from the date of this agreement
'European Common Market' shall mean the countries of Belgium, France, The Netherlands, Italy, Luxembourg and West Germany (excluding the territories possessions and protectorates of the said countries outside the continent of Europe)
'Exclusive licence' shall mean a licence conferred on a licensee by the patentee to the exclusion of all other persons, including the patentee
'Force majeure' shall mean act of god the elements fire flood riot insurrection industrial dispute inevitable accident war embargoes legal restrictions or any other cause beyond the control of the parties
'Forthwith' shall mean not later than ten days after receipt of notice in writing
'Great Britain' shall mean England, Scotland, Wales and the Isle of Man
'Improvement' shall mean a technical advance relating to the licensed product
'Industrial realisation' shall mean the translation of an invention into a technically viable product
'Intellectual property' shall mean information, inventions, design and copyright material relevant to the licensed product and at the free disposal of either party at the date this agreement shall be deemed to have come into force
'Know-how' shall mean all the expertness, practice, experience and technical knowledge of industrial significance built up in one organisation and not in the public domain necessary to permit the licensee to make the licensed product
'Licenced process or processes' shall mean any and all processes which are devised and utilised to produce the licensed product as herein defined

LICENSOR'S RIGHTS AND OBLIGATIONS

CLAUSE 6 - Trademarks and trade names
The licensor shall permit the licensee to use the trademarks and trade names set out in schedule C in connection with the making sale and promotion of the licensed product within the territory subject to and in the manner provided in this agreement

CLAUSE 7 - Technical assistance (1)
The licensor shall furnish to the licensee in good faith and without reservation all secret data samples publications technical assistance and advice and one copy each of all standards specifications drawings formulae blueprints and other informations that may reasonably be necessary for the use and exploitation of the licence

CLAUSE 8 - Technical assistance (2)
The licensor undertakes to instruct employees of the licensee in and to explain to them the manufacture of the licensed products at the licensor's own works at (town) on the following terms and conditions:

CLAUSE 9 - Technical assistance (3)
The licensor at the licensee's expense shall give such consultative assistance as may be reasonably necessary on technical matters relating to the licensed product (including not more than (number) visits totalling (number) man-days in all by a member or members of its technical staff in any twelve-month period during the life of this agreement) on the following terms and conditions:

CLAUSE 10 - Marketing assistance
The licensor shall supply the licensee from time to time with current marketing information about promoting the product and details of new applications

CLAUSE 11 - Licensor's improvements
The licensor shall disclose and make available to the licensee any modifications improvements or inventions relating to the licensed product or its method of manufacture but shall not be entitled to an increase in royalties in respect thereof unless such modification improvemer or invention is the subject of an application by the licensor for letters patent when the provisions of clause 12 shall apply

CLAUSE 12 - Licensor's patentable improvements
If any modification improvement or invention made by the licensor relating to the licensed product is the subject of a patent application by the licensor then the licensor shall not be obliged to give any particulars of such modification improvement or invention to the licensee unless and until the licensee enters into a further agreement relating to that modification improvement or invention, such agreement to contain terms and conditions not less favourable to the licensee than those contained herein

CLAUSE 13 - Licensor's use of licensee's improvements
The licensor shall be entitled without charge to make use of modifications improvements and inventions relating to the licensed product suggested or made by the licensee provided that such use does not involve the disclosure of the said modifications improvements and inventions to any third party until they have come into the public domain (through no breach of the agreement) or been published by the licensee

CLAUSE 14 - Licensor's use of licensee's patentable improvements (1)
If the licensor should secure the grant of letters patent or similar protection in (licensor's homeland) or in the territory in respect of any modification improvement or invention relating to the licenced products disclosed to it by the licensee then the licensor shall grant to the licensee if requested to do so in writing a licence under such letters patent or similar protection upon terms not less favourable than those contained herein. If the laws and regulations of the territory permit the application for letters patent or similar protection or the grant in respect of any modifications improvements or inventions relating to the licenced products thereof to be made only by or to the licensee then the licensee shall assign to the licensor without delay all rights of the licensee in the application or grant of the letters patent or similar protection

CLAUSE 15 - Licensor's use of licensee's patentable improvements (2)
If the modifications improvements or inventions suggested or made by the licensee are patentable the licensor shall be entitled to obtain letters patent in its name in all countries except the territory without being required to make any payment to the licensee, and the licensee shall assign its rights in such modifications improvements and inventions to the licensor as may be necessary to enable the licensor to obtain such letters patent

CLAUSE 16 - New uses of products
The licensor undertakes to inform the licensee in good faith and without reservation of any uses of the licensed product not envisaged by the licensor at the time when this agreement was made which subsequently appeared to the licensor to be practicable and which the licensor proposes to put into effect

CLAUSE 17 - Risks of realisation and exploitation
The licensor does not warrant that the invention is capable of industrial realisation or commercial exploitation. The risks of such realisation and exploitation shall be assumed solely by the licensee provided that nothing hereinbefore contained shall affect the right of either party to terminate this agreement

CLAUSE 18 - Accuracy of information disclosed
Information disclosed by the licensor to the licensee shall be accurate to the best of the licensor's knowledge and belief but the licensor gives no warranty of any kind whatsoever either express or implied as to the accuracy of such information relating to any patents or any or all of the said methods processes techniques informations knowledge know-how trade practices and any secret data communicated to the licensee

CLAUSE 19 - Information disclosed and third party rights
The licensor makes no representation that the use of information disclosed by the licensor to the licensee under this agreement does not infringe third party rights

CLAUSE 20 - No warranty of patents
Nothing in this agreement shall be construed as a representation or warranty that the said letters patent are valid or that the manufacture or sale hereunder is not an infringement of any valid and subsisting letters patent not held by the licensor

CLAUSE 21 - No claim against licensor
No claim of any sort shall lie against the licensor arising from the use of information disclosed by the licensor in accordance with the terms of this agreement whether such information be accurate or not

CLAUSE 22 - Ownership
All informations and secret data furnished by the licensor shall remain the sole and exclusive property of the licensor and shall not be used by or disclosed to any third parties by the licensee save as provided in this agreement

CLAUSE 23 - Patents left in force and renewal
The licensor shall keep in force the letters patent on which the licence is based. The licensee shall pay the costs of the requisite renewal fees

CLAUSE 24 - No obligation to defend legal proceedings
The licensor shall be under no obligation to institute or defend any legal proceedings whether for infringement or otherwise in respect of the said obligations of the letters patent

CLAUSE 25 - Revocation and royalties
If letters patent the subject of this agreement are revoked at the instance of a third party the licensor shall be entitled to retain any royalties already paid and to have paid any royalties due but unpaid at the date of such revocation

CLAUSE 26 - No liability for loss
The licensor shall be under no liability hereunder to the licensee on account of any loss damage or delay caused by strikes riots fires insurrection or elements embargoes failure of carriers inability to obtain material or transportation facilities acts of god or of the public enemy or compliance with any law or regulation or other governmental order whether or not valid or other causes beyond the control of the licensor whether or not similar to the foregoing

CLAUSE 27 - Exclusivity of licence
The licensor shall not (save as hereinafter provided) make or sell the licensed product or cause it to be made and sold by any third party within the territory

CLAUSE 28 - Waiver
No provision of this agreement shall be deemed to be waived by any act omission or knowledge of the licensor its agents or employees except and only by an instrument in writing expressly waiving such provision signed by a duly authorised officer of the licensor

CLAUSE 29 - Ownership of leased machinery
The leased machinery shall at all times remain and be the sole and exclusive property of the licensor and the licensee shall have no right of property therein but only the right to use the same (upon the conditions herein contained). The leased machinery shall be used only by the licensee himself or by operatives in his direct employ and only in the factory now occupied by him at (town) in (country) where it shall be regularly maintained and adequately insured by the licensee

CLAUSE 30 - Determination of agreement
The licensor shall have the right to determine this agreement forthwith by notice in writing to the licensee upon the happening of any of the following events:
a If any royalty payable under this agreement whether formally demanded or not shall be in arrear for 28 days or more
b If the licensee having failed to perform or observe a covenant on their part to be performed or observed under this agreement shall not have rectified their failure before the expiration of the period of 14 days next following the date of the giving by the licensor of a notice in writing specifying the said failure
c If the licensee shall have a receiver appointed of the whole or any part of their assets or if an order shall be made or a resolution passed for winding up the licensee unless the licensor agrees that such order or resolution is part of a scheme of reconstruction of the licensee
d If the licensee shall be amalgamated with or become a subsidiary of any other company or be purchased by a person firm company corporation or other organisation

THE LICENSEE'S OBLIGATIONS AND RIGHTS

CLAUSE 31 - Date of manufacture

The licensee shall begin manufacture and sale of the licensed product within a period of (number) months from the date of this agreement

CLAUSE 32 - Restrictions on use of information

The licensee shall use the information disclosed by the licensor under this agreement for the sole purpose of manufacturing the licensed product for sale to third parties in accordance with the provisions of this agreement

CLAUSE 33 - Transfer of documents

Before specifications drawings formulae secret data models and documents (the intellectual property) are transferred the licensee shall pay to the licensor's account number (list) at (name) bank (address) to the credit of the licensor the sum of (give) in pounds sterling. The licensor will transfer the said intellectual property to the licensee only upon satisfactory proof that the whole of the said sum has been paid to the said bank. The licensee shall not be entitled to the return of this sum by reason of the fact that this agreement has for any reason been prematurely terminated

CLAUSE 34 - Royalty

The licensee shall pay to the licensor for the continuance of this agreement a royalty of (agreed) percent of the net ex works selling price (that is to say after deduction of ..... purchase tax, trade discounts and costs of packing insurance carriage and freight) of all licenced products sold by the licensee

Statements of the royalty due to the licensor shall be rendered by the licensee annually within one calendar month of the end of the licensee's financial year to the licensor and payment of the royalty shall accompany the statement which shall be certified by the licensee's auditors if so requested by the licensor

All royalties that may be due to the licensor hereunder shall be paid by the licensee to the licensor in (pounds sterling) in (London) converted from the currency in which such sums were calculated at the selling rate for that currency as quoted on the (London foreign exchange) market on the last day of the period in respect of which such sums were payable

CLAUSE 35 - Minimum royalty

Royalties payable under this agreement shall not be less than the sum of (agreed) pounds sterling in the first year
(agreed) pounds sterling in the second year
(agreed) pounds sterling in the third year and each succeeding year or the sum of the royalties payable in respect of the licensee's annual sales in each year whichever is the greater. If the agreement is in force for less than twelve months in any calendar year the minimum royalties shall be reduced accordingly

CLAUSE 36 - Royalties when due
The licensor's right to royalty occurs on receipt by the licensee of payment from his purchaser

CLAUSE 37 - Royalty records and payment
The licensee shall keep true and particular records of all royalties payable under this agreement and shall 28 days after the last day of (month) in each year during which this agreement shall remain in force deliver to the licensor a true account thereof (such account being certified by the licensee's auditors at the request of the licensor) in respect of the preceding year or any part thereof in the last year of this agreement (up to the end of the last preceding (month) as the case may be) and shall at the same time pay to the licensor the amount of such royalties as may be shown to be due together with any additional sum that may be due to the licensor under the provisions of clause 47 hereof provided that if this agreement shall terminate or determine otherwise than at the end of (month) the last account and payment under this agreement shall be rendered and made respectively within 28 days after the termination of this agreement

CLAUSE 38 - Inspection of accounts
The licensee shall permit any duly authorised representative of the licensor at all reasonable times to inspect and take copies of and extracts from the records kept by the licensee in respect of the manufacture sale and distribution of the licensed product and shall produce to such representative all receipts and vouchers relating thereto

CLAUSE 39 - Local taxes
Any direct or turnover taxes levied in the country of the licensee shall be paid by the licensee

CLAUSE 40 - Competing products
The licensee shall not engage in any way either on their own behalf or on behalf of others in the manufacture distribution or sale of any product of such a nature as would or might be likely to compete or interfere with the manufacture distribution or sale of the licensed product

CLAUSE 41 - Promoting the product
The licensee shall promote by every means in their power the distribution and sale of the licensed product throughout the territory and shall make every effort at all times to meet the demand for the licensed product throughout the territory

CLAUSE 42 - Restricting the product
The licensee shall not enter into any agreement with any third party the effect of which would be directly or indirectly to limit or restrict the manufacture distribution sale or use of the licensed product in the territory

CLAUSE 43 - Sales force
As soon as possible after the signing of this agreement the licensee shall develop a specialised sales and service organisation for the distribution and sale of the licensed product within the territory

CLAUSE 44 - Where licensee may not manufacture
The licensee shall manufacture the licensed product only in the territories specified in this agreement and shall not manufacture or have manufactured the said licensed product in any other territory whatsoever

CLAUSE 45 - Where licensee may export
The licensee shall export only to the following (list countries)

CLAUSE 46 - Ban on exports
The licensee as sole/exclusive licensee for the territory shall not export or permit any third party to export the licensed product outside the territory and the licensee shall inform the licensor of any infringement of this clause of which he becomes aware and the licensee shall take all practicable steps to stop such infringement always provided that nothing hereinbefore contained shall apply in respect of any bona fide sale of the licensed product made by the licensee to a customer in the ordinary course of the licensee's business

CLAUSE 47 - Liquidated damages
for each and every breach of their obligations referred to in clauses 44, 45 & 46 hereof the licensee shall pay to the licensor as liquidated damages the sum of (agreed) pounds sterling

CLAUSE 48 - Advertising
The licensee at his own cost shall effectively advertise the licensed product throughout the territory. Upon the production of any advertising literature posters photographs or other publicity material the licensee shall forthwith send two copies thereof by airmail to the licensor for retention

CLAUSE 49 - Failure to meet demand
If the licensee is unable at any time to meet the demand for the licensed product in the territory because of insufficient productive capacity and the licensee fails to increase the productive capacity of his works sufficiently to meet the said demand after three month's notice in writing from the licensor requiring him to do so then the sole right to manufacture and sell the licensed product inside the territory granted to the licensee under the terms of this agreement may be terminated by the licensor who shall then be free to appoint any other person company firm corporation or body to manufacture and sell the licensed product in the territory in addition to the licensee

CLAUSE 50 - Use of trademarks (1)
In so far as the laws and regulations of the territory allow the licensee shall apply the trade marks listed in schedule C annexed hereto to all the licensed products manufactured by the licensee before such licensed products are advertised, distributed and sold (unless the licensor shall agree otherwise in writing) and shall use the said trademarks in all publicity, technical and other printed matter (copies of which shall be supplied to the licensor) relating to the said licensed products. The licensee shall not apply and use any other trade mark whatsoever on or in connection with the licensed products. For the purposes of this clause the term 'trademark' shall have the meaning ascribed to the terms 'mark' and 'trade mark' in the Trade Marks Act 1938

CLAUSE 51 - Use of trademarks (2)
The licensee is granted no right or title or interest in or to the licensor's trademark except as expressly provided in this agreement and the use of the said trademark is and shall be for the exclusive benefit of the licensor. If the licensee should develop adapt or acquire directly or indirectly any right title or interest in or to the said trademark or in any goodwill generated in connection with it the licensee shall upon receiving a request in writing from the licensor to that effect assign to the licensor or such person or firm as may be nominated by the licensor all right title or interest in or to the said trademark together with the goodwill of the business in connection with which the said trademark is being used

CLAUSE 52 - Revocation of trademark
The revocation of a trademark or trademarks set out in schedule C annexed hereto or its/their lapsing by reason of non-payment of renewal fees or a declaration by the competent authority in the territory that the same is invalid shall not of itself be a ground for determining this agreement

CLAUSE 53 - Trademark infringement (1)
The licensee shall make every effort at all times to detect any infringements or attempted or suspected infringements of the said trademark and shall immediately notify the licensor thereof and shall keep them fully informed of any proceedings involving the validity of the said trademark

CLAUSE 54 - Trademark infringement (2)
If during the life of this agreement the licensor shall become aware whether by notification by the licensee or otherwise of any infringement or attempted or suspected infringement of the said trademark the licensor shall notify the licensee within three months whether or not it intends to initiate proceedings to prevent infringement. If the licensor notifies the licensee that it does not intend to do so or fails to give any notification whatsoever within the said period of three months the licensee may if it so desires take such proceedings to prevent such infringement or to defend the validity of the said trademark as seems expedient to it and shall keep the licensor fully informed. If the licensee takes any such proceedings as aforesaid the licensor shall render all assistance in its power to the licensee in connection therewith. All costs and expenses in respect of such proceedings in so far as such costs and expenses relate to infringement shall be borne by the licensee and in so far as they relate to the validity of the said trademark shall be borne by the licensor. Any such costs and expenses which cannot readily be apportioned in the aforesaid manner shall be borne equally by the parties hereto

CLAUSE 55 - Trademark validity and ownership
At no time during the life of this agreement or after its termination for whatever reason shall the licensee dispute the validity of the said trademark or the right of the licensor to the absolute ownership of the same or use the said trademark in any manner contrary to the interests of the licensor

CLAUSE 56 - Patent opposition
During the period of this agreement the licensee shall not oppose or assist others to oppose a grant or renewal of letters patent in respect of said invention nor shall the licensee dispute or assist others to dispute the validity of the said letters patent or any of the claims thereof

CLAUSE 57 - Infringement of patents
The licensee shall take all reasonable steps to prevent the patents listed in Schedule A being infringed in the territory and shall notify the licensor of any such infringements which come to their notice

CLAUSE 58 - Maintaining patents
All costs connected with patent applications and renewals in respect of the licensed products in the territory shall be borne by the licensee but may be partially recovered by the licensee as set out hereunder. The licensee shall be permitted to deduct from the amounts agreed to be paid under clauses 33, 34 or 35 hereof half the actual out-of-pocket costs incurred in respect of the aforesaid patent applications and renewals

CLAUSE 59 - Legal proceedings
The licensee shall be under no obligation to institute or defend legal proceedings whether for infringement or otherwise in respect of the said letters patent

CLAUSE 60 - Validity of patents
In the event of any or all of the relevant applications being abandoned or becoming void before the grant of letters patent or of all the relevant patents being refused or declared invalid such reduction may be made in the royalties payable hereunder from the date of such abandonment avoidance refusal or declaration as may be agreed by the parties hereto to be reasonable in the circumstances

CLAUSE 61 - Assignment of rights
The licensee shall not assign merge charge or part with any of their rights or obligations under this agreement or grant sub-licences without the previous consent of the licensor in writing which consent may be subject to conditions including financial conditions without prejudice to the foregoing

CLAUSE 62 - Licensee not the agent
The licensee is neither the agent nor legal representative of the licensor and no authority or right is conferred upon the licensee by this agreement to assume any obligation of any kind expressed or implied on behalf of the licensor or to bind them in any way

CLAUSE 63 - New uses of product
The licensee undertakes to inform the licensor in good faith and without reservation of any uses not envisaged by them at the time when the agreement was made which subsequently appear to them to be practicable and which they propose putting into effect

CLAUSE 64 - Disclosure of information
The licensee shall supply the licensor with all information on the manufacture distribution and sale of the licensed product which may come into their possession unless they hope reasonably to keep such information confidential and the licensor shall be entitled to disclose such information to any person company firm or body with whom the licensor has an agreement similar to this

CLAUSE 65 - Marking the product
With respect to every licensed product made and sold under the provisions of this agreement the licensee shall on some conspicuous part thereof or on a durable label firmly attached thereto mark or cause to be marked in such characters as to be easily seen and read and in such manner as not to be readily defaceable either:
a words indicating that letters patent have been applied for in (country) in respect of the licensed product
or b (if the said licensed product has been manufactured after letters patent have been granted in (country) in respect thereof) the words '(product) patent number' followed by the number of the said patent number

CLAUSE 66 - Periodic reports to licensor
The licensee shall supply to the licensor within 28 days after the four quarterly dates respectively in each year during which this agreement is in force a report in writing in any such form as the licensor may from time to time require giving:
a The type quantity and detailed labour and raw material costs of all the licensed products manufactured during the preceding quarter
b The scale of current prices charged to purchasers with details of any discounts and extent of any credit
c The quantity and details of all the licensed products despatched to purchasers during the preceding quarter
d Details of all orders for the licensed product which have not yet been supplied at the end of the quarter
e The quantity and detail of unsold licensed products held by the licensee at the end of the quarter in question
f All information available to the licensee about similar products encountered during the quarter and all other information likely to affect the interests of the parties to this agreement
g The names and addresses and such other information as may be of interest to the licensor of all distributors and sub-distributor for the licensed product appointed in the territory by the licensee

CLAUSE 67 - Purchase of parts
For the manufacture of the articles under licence the licensee undertakes to buy from the licensor the parts set out in schedule D. The said parts shall be supplied in accordance with the general conditions annexed thereto and the prices shall be the licensor's catalogue prices at the relevant time

CLAUSE 68 - Ownership of equipment
The licensee hereby agrees that the equipment described in schedule E and the title thereto, notwithstanding delivery, shall belong to and be vested in the licensor until the full purchase price shall have been paid by the licensee

CLAUSE 69 - Modification to product
The licensee shall disclose to and obtain the consent of the licensor before making modifications to or applying improvements or inventions to the licensed product

CLAUSE 70 - Improvements and inventions
If during the life of this agreement the licensee shall discover or make any modification improvement or invention relating to the licensed product or the method of manufacture or use or application thereof the licensee shall disclose the same immediately to the licensor who shall be entitled to the full beneficial ownership thereof throughout the world. At the request in writing and at the cost of the licensor the licensee shall execute and carry into effect all such instruments and do all such things as the licensor may require for the purpose of acquiring full beneficial ownership of the property in such improvement or invention and of securing for it patent or other protection throughout the world in the name of the licensor provided that if the licensor shall not notify the licensee within a period of six calendar months of receiving such disclosure as mentioned above that they intend to retain for their own beneficial ownership and use such improvement or invention then the licensee may if they so desire within eight weeks of the end of such period of six calendar months inform the licensor in writing that they intend to apply for patent or other protection in the territory for the same in their own name for their own benefit and at their own cost

CLAUSE 71 - Changes in manufacturing methods or equipment
The licensee shall at their own expense and without delay carry into effect all changes necessary to materials machinery plant equipment and methods arising from any alterations in the specifications or standards of quality of the licensed product that may from time to time be required by the licensor provided that the licensee shall have a reasonable time to carry into effect any changes which involve major expenditure

CLAUSE 72 - Accessory or adjunct
The licensee shall not advertise sell cause to be sold or recommend any product as an accessory or necessary adjunct to the licensed product without the approval in writing of the licensor

CLAUSE 73 - Use of trademark
The licensee shall not use the said trademark in any manner whatsoever except as expressly provided in this agreement. The licensee shall not use any colourable imitation of the said trademark and shall not at any time without first obtaining the consent in writing of the licensor use the word (product) in the name title or style of any company firm or body whatsoever now or hereafter to be formed by the licensee or in which the licensee has or will have a controlling interest

CLAUSE 74 - Quality control
The licensee shall manufacture the product to the same quality as is done by the licensor who shall provide all necessary assistance as set out hereinbefore so to do. The licensee shall buy all raw materials to be used in making the licensed product from the licensor or from such person company firm or body as may be nominated or approved in writing by the licensor

CLAUSE 75 - Right to inspect
The licensee shall allow the licensor or their authorised representative at all reasonable times to enter the works warehouses or offices of the licensee to inspect materials machinery plant methods and standards of manufacture currently in use for producing the licensed product and the licensee shall at such intervals as the licensor may think fit supply the licensor with samples of currently produced (products). If in the sole opinion of the licensor or their authorised representative any licensed product made by the licensee does not conform in every respect with the current specifications and standards of quality laid down by the licensor then the licensor shall notify the licensee in writing to that effect and the licensee shall not thereafter sell such products under the said trademark or dispose of them in any way except as the licensor shall approve

CLAUSE 76 - Warranty
The licensee shall give to buyers of the licensed product in the territory a warranty as to the quality reliability and suitability of the licensed product for the purposes for which it is recommended and sold and in order fully to be able to meet any claims from buyers that may arise by virtue of such warranty shall take out an insurance policy with such insurers and upon such terms as shall be approved in writing by the licensor provided that the terms of such warranty shall not be more onerous in any respect to the licensee or wider in scope than the terms of the warranty given from time to time during the life of this agreement in respect of the licensed product manufactured and sold by the licensor in the UK

CLAUSE 77 - Determination (1)
On determination of this agreement for any reason whatsoever the licensee shall deliver to the licensor forthwith all books drawings and other documents samples tools and models received from the licensor relating to the products or any inventions and improvements in respect of the products

CLAUSE 78 - Determination (2)
The licensee shall be entitled to complete after the expiry of this agreement contracts of sale entered into by him before such expiry

CLAUSE 79 - Determination (3)
Recognising that the technical information and assistance which will have been given to the licensee during the term of this agreement by the licensor will continue after the termination thereof to be useful and have value in the manufacture use and sale of the said products the licensee shall continue to pay the licensor a percentage specified in clause 34 hereto for a period of six months next following such termination

CLAUSE 80 - Determination (4)
On the termination of this agreement at any time and for whatever reason the licensee their servant and agent shall not thereafter make sell or promote within the territory any product of a nature similar to or comparable with the licensed product for a period of five years from the date of such termination

CLAUSE 81 - Determination (5)
On the termination of this agreement at any time and for whatever reason the licensor shall have the right within three months of the date of such termination to purchase from the licensee either directly or by such representatives as the licensor shall appoint, all or any part of the licensee's unsold stock of the licensed product and unused stocks of raw materials for use solely in the manufacture thereof. The value of such unsold stocks of the licensed products shall be fixed at the ex-works price in force at the date of the exercise of the said right by the licensor less insurance and packing charges and the value of such unsold stocks of raw materials shall be fixed at the purchase price paid for them by the licensee or if this cannot be ascertained with certainty at the current market price for such raw materials

CLAUSE 82 - Determination (6)
On the termination of this agreement the licensee on request in writing by the licensor shall supply forthwith a list of names and addresses of all purchasers from the licensee of the licensed product in quantities exceeding (number, value or weight) at any one time

CLAUSE 83 - Determination (7)
Upon the termination of this agreement at any time and for any reason the licensee shall cease forthwith to use the trademarks set out in schedule C annexed hereto, in connection with any goods and shall cease forthwith to use any word name mark or device so nearly resembling the said trademarks as would infringe upon the said trademarks or which might be calculated to confuse or deceive purchasers or prospective purchasers of the licensed product and shall dispose of all publicity and technical literature or other printed matter upon which the said trademark appears as may be specified by the licensor

CLAUSE 84 - Determination (8)
The licensee after the expiration of this agreement shall not use for any purpose whatsoever or communicate to a third party information concerning the production manufacture or marketing of the licensed product disclosed to the licensee by the licensor under the terms thereof

CONCERNING BOTH PARTIES

CLAUSE 85 - Registration of licence
Subject to the regulations of the country concerned either party shall be entitled to register the licence at the patent office if such registration is permissible or necessary under the law of the country or countries in respect of which the licence is granted. The licensor shall give the licensee any powers or authorisations necessary for this purpose. The expense of registration shall be borne by the party desiring to register or required to register the licence

CLAUSE 86 - Arbitration
Any dispute arising out of or in connection with this agreement including whether or not it is a valid agreement shall be finally settled without recourse to the courts in accordance with the rules of conciliation and arbitration of the International Chamber of Commerce by one or more arbitrators designated in conformity with those rules.

CLAUSE 87 - Addresses
All notices requests demands and other communications under this agreement or in connection therewith shall be given to or made upon the respective parties as follows at the addresses stated on the first page of this agreement
a In the event that any party hereto shall change his address notice to this effect shall be given to the other parties within 28 days thereafter
b All notices requests demands and other communications given or made in accordance with the provisions of this agreement shall be in writing and shall be sent by registered airmail and shall be deemed to have been given when deposited in the mail of the sender's country postage prepaid

CLAUSE 88 - Determination (9)
Determination of this agreement and the said licence shall be without prejudice to any rights of either party against the other which may have accrued up to the date of such determination

CLAUSE 89 - Execution in duplicate
This agreement shall be executed in duplicate each party having a signed copy thereof which shall be deemed to be an original

In witness whereof the licensor and licensee have caused their common seals to be affixed hereunto the day and year first above written

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