Available online at www.sciencedirect.com
SCIENCE DIRECT®
International Business Review 14 (2005) 655–675
INTERNATIONAL BUSINESS REVIEW
www.elsevier.com/locate/ibusrev

Firm configuration and internationalisation: A model

Peter J. Buckley [a], Niron Hashai [b,*]

[a] *Centre for International Business, Leeds University Business School, Maurice Keyworth Building, Leeds LS2 9JT, UK*
[b] *Jerusalem School of Business Administration, The Hebrew University, Mt Scopus, Jerusalem 91905, Israel*

Received 16 January 2005; received in revised form 7 June 2005 and 16 August 2005; accepted 9 September 2005

Abstract

We present a discrete choice model that analyses the *location* and *control* dilemmas of internationalising firms. The model relates simultaneously to a foreign market and to a foreign resource abundant country, and distinguishes between costs of performing specific value adding activities, costs of transportation and knowledge flows cost. The model also offers an economics-based dynamic dimension to firm internationalisation and reflects the role of host country knowledge resources.

Keywords: Internationalisation; Internalisation; Location; Knowledge flow; Firm configuration; Knowledge asset seeking

1. Introduction

The 'economic school' of thought has been tremendously influential in International Business (IB) research. Scholars adhering to this school (e.g. Anderson & Gatignon, 1986; Buckley & Casson, 1976; Dunning, 1977, 1988; Hennart, 1993; Hirsch, 1976; Rugman, 1981, 1986) focus on the advantages gained from internalising the firm's foreign activities during its international expansion. Internalisation enables the firm to minimise the cost of economic transactions by better exploiting underutilized firm-specific capabilities (e.g. managerial skills and technology), which are superior to those of indigenous competitors.

Notwithstanding the central role that the 'economic school' plays in IB research, a few shortcomings characterise this literature. First, it is mostly confined to a 'home country–host country' view, thus neglecting the fact that a firm may often expand *in parallel* to foreign markets and to resource abundant countries. Second, with a few exceptions (e.g. Buckley & Casson, 1976, 1998), the 'economic school' treated the firm as a 'black box' and did not

* Corresponding author. Tel.: +972 2 588 3110; fax: +972 2 588 1341.
E-mail addresses: pjb@lubs.leeds.ac.uk (P.J. Buckley), nironh@huji.ac.il (N. Hashai).

0969-5931/$ - see front matter
doi:10.1016/j.ibusrev.2005.09.003

distinguish between the motivations to internationalise different value adding activities of the firm. Third, this school was mainly focused on static analyses of the choice between alternative foreign market servicing modes, thus neglecting the dynamic dimension of firm internationalisation. Finally, in many cases, scholars coming from this school have explicitly or implicitly assumed that the internationalising firm possesses some kind of 'home-based' competitive advantage, hence neglecting the potential impact that 'host country' knowledge resources may have on the competitiveness of internationalising firms (Cantwell, 1995; Dunning & Narula, 1995; Kuemmerle, 1997; Zanfei, 2000).

The current paper offers a method to overcome these shortcomings by using a discrete choice model that follows the reasoning of the 'economic school', analyses the economic cost of different kinds of transactions and identifies those that minimize overall costs. We make a few simplifying assumptions for the sake of clarity, but our model offers a method to simultaneously include a foreign market and a resource abundant country, to open the 'black box' of the firm and to predict the location and control modes of specific value adding activities, to allow a dynamic dimension to firm internationalisation and to reflect the role of host country knowledge resources.

Next, we briefly detail the relevant literature in the context of our proposed model. The features of our model and its underlying assumptions are presented in Section 2. Then we formulate and solve the model and specify the criteria according to which firms are expected to make their location and control decisions. We follow this by extending the static formulation into a dynamic one and finally we conclude and present suggestions for further research.

2. Literature review

Essentially, the 'economic school' views internationalisation as engagement in cross border activities motivated by rational economic considerations (e.g. Buckley & Casson, 1976, 1998; Dunning, 1977, 1988; Hirsch, 1976; Martin & Salomon, 2003; Rugman, 1981, 1986). Firms choose their foreign market-servicing mode by evaluating the cost of different transactions and selecting the mode that minimises overall costs.

Dunning's Eclectic Paradigm (Dunning, 1977, 1988) probably offers the most holistic description of the conditions of foreign market-servicing strategy of firms using ownership, location and internalisation advantages as explanatory variables. Ownership advantages reflect firm-specific, technological, marketing or managerial knowledge, such as privileged access to resources not available to competitors. Location advantages represent the comparative cost of materials, labour and natural resources accessed by enterprises operating in a particular host country as well as the relative proximity to potential foreign markets and suppliers. Internalisation advantages apply to the case, where a firm prefers to exploit its ownership advantage within its organisational boundaries, rather than by licensing or the use of other modes of externalisation (Buckley & Casson, 1976, 1998; Hennart, 1993; Martin & Salomon, 2003; Rugman, 1981, 1986).

Within the 'economic school' of thought, our model specifically builds on Hirsch's (1976) path breaking paper. This paper has influenced many classic internationalisation models (e.g. Buckley & Casson, 1976; Rugman, 1981) as well as more recent ones (Martin & Salomon, 2003). Hirsch's paper was especially pioneering in its focus on the interaction between supply and demand factors in the explanation of firm's choice between FDI and exports. These factors are: differences in production costs between the home and host countries, the cost of possessing and transferring proprietary know-how, the excess cost of marketing in the host country compared to the domestic market and the additional costs of controlling and coordinating foreign operations compared to domestic ones.

The current paper extends the basic building blocks of Hirsch (1976). First, the paper presents a formal model that explains the configuration of internationalising firms in a world that is made up of the home country, a target country (where the firm's foreign market exists) as well as a resource abundant country. By simultaneously including a foreign market and a foreign resource abundant country, we expand beyond conventional home–host country analyses.

Second, our model refers to the cost of executing various value adding activities in different locations, intra-firm and inter-firm knowledge flow costs and the cost of product flows to customers. Essentially, our model presents internationalisation (i.e. the expansion of a firm's activities beyond its national boundaries) as a consequence of the firm's decisions on its optimal configuration, where the overall costs of operations and flows are minimised.

We define a firm's configuration as the location of, and control over value-adding activities. We follow Buckley and Casson (1976); Casson (2000), and Hirsch (1976) and focus on three major value-adding activities: (1) R&D—creation of knowledge and consumable technology, (2) production—transforming inputs into outputs, (3) marketing—which includes promotion, sales, distribution and after-sales services.

The firm's location and control decisions are both determined by the *interrelation* between the cost of executing these value-adding activities in various locations, knowledge flow costs between these activities (Buckley & Carter, 2004; Kogut & Zander, 1993; Martin & Salomon, 2003) and the cost of product flows to the market. The location decision is *where* to locate each value-adding activity so that the overall costs are minimised. The control decision is *which* value-adding activity to *internalise* (own or control) and which to *externalise* (i.e. perform outside the firm's boundaries through arms-length transactions, licensing or outsourcing) in order to minimise costs.

Third, our model offers a dynamic extension to the firm's decisions on its optimal location and control configuration. This is done by returning to the underlying logic of the product cycle framework (Vernon, 1966). While the framework has been criticized for being too deterministic and being relevant mainly to the technology-based products (Melin, 1992), it has remained central in IB literature. In the framework, products typically pass through the phases of introduction, growth and maturity (and finally decline). The location of new products is influenced by the proximity of innovators to their home country customers. In the introductory phase, when products are not yet standardized, the innovators locate production activities at home in order to facilitate interaction between R&D and production. During the growth phase, the demand for products expands into additional markets and, over time, the innovators locate production activities in proximity to consumers in these countries. As products continue to mature, they become more and more standardised. First mover advantages are dissipating and production cost considerations become critical. During the maturity phase, production will be transferred to countries that enjoy cost advantages. Hence, according to the product cycle framework, over time the relative importance of R&D and knowledge flow costs decline compared to that of production, marketing and product flows.

Finally, our model also refers to host country knowledge resources by considering the question of where R&D activities of the internationalising firm should be located. The internationalisation of knowledge creation (often referred to as R&D) activities is receiving increasing attention in the literature (e.g. Cantwell, 1995; Dunning & Narula, 1995; Kuemmerle, 1997; Patel & Pavitt, 1991; Patel & Vega, 1999; Pearce & Papanastassiou, 1996, 1999; Zanfei, 2000) and hence should be incorporated in the firm's choice of its optimal configuration.

We employ a discrete choice model to analyse the decision-making of an internationalising firm regarding the location and control of its value-adding activities. The main advantage of such a model is the ability to enumerate all the possibilities, evaluate them separately and rank them according to different criteria. Then, alternatives that are dominated by others are eliminated, and at the end of the process the remaining alternatives are evaluated according to inequalities between specific variables. This approach follows the reasoning of 'economic school' (e.g. in Buckley & Casson, 1976; Casson, 2000; Hirsch, 1976; Martin & Salomon, 2003; Rugman, 1981) by asserting that profit maximisation is achieved through minimising the costs of the firm's value-adding activities, the costs of knowledge flows between value-adding activities and the cost of product flows to customers.

The deficiency of this methodology is that as the number of variables increases, we face a 'combinatorial explosion' since the number of permutations accelerates accordingly (Casson, 2000), chap. 3. In order to overcome this problem, some simplifying assumptions are made. While these assumptions may in some cases change the firm's decision set, our main point is to demonstrate a solvable method that enables a more holistic and rigorous view of the location and control dilemmas of internationalising firms. We return to this point in Section 6.

3. The model

3.1. Structure

Consider a firm that produces a single consumer good in a single plant. As mentioned earlier, three types of activity are involved in the firm's operations: R&D (denoted by R), Production (denoted by P) and Marketing (denoted by M). There are three possible locations: A, the home country, B, a destination country, where the firm's main foreign market exists, and W, a resource-abundant country, where production inputs are expected to be the cheapest. We assume that the market in country B is large enough to justify the operation of dedicated value-adding activities. Thus, the home market does not play a role in the location and control decisions of the firm.

In order to simplify the model, we assume that the location of value-adding activities is mutually exclusive—there is no duplication of identical value-adding activities in different countries. In practice, internationalising firms may locate a specific value-adding activity in multiple locations, so the above assumption implies that for each value-adding activity (R, P or M), a major location is chosen by the firm.

While *P* can be located at any of three locations, R and M must be located at A—near the firms' headquarters or at B—close to the firm's market. This assumption reflects the view that there is not much sense in locating R&D or marketing at W, away from both the firm's headquarters (which are assumed to be located in A) and its market. This view is consistent with the view of many scholars regarding the location of marketing activities (Dunning, 1988; Hirsch, 1976; Johanson & Vahlne, 1977, 1990) and that the location of R&D in low cost countries is still unusual (Dunning & Narula, 1995; Kumar, 2001; Pearce & Papanastassiou, 1996, 1999; Rao, 2001).

Following these assumptions, a firm operating in the above-mentioned world has a relatively small number of location possibilities to choose from: 2 (for R)$\times$3 (for P)$\times$2 (for M)$=$12 possibilities. This view is portrayed in Fig. 1 and formally detailed in the following sections.

An R&D laboratory is denoted by a circle, a production plant by a square and a marketing facility by a diamond. Flows of products are denoted by thick lines while flows of knowledge are

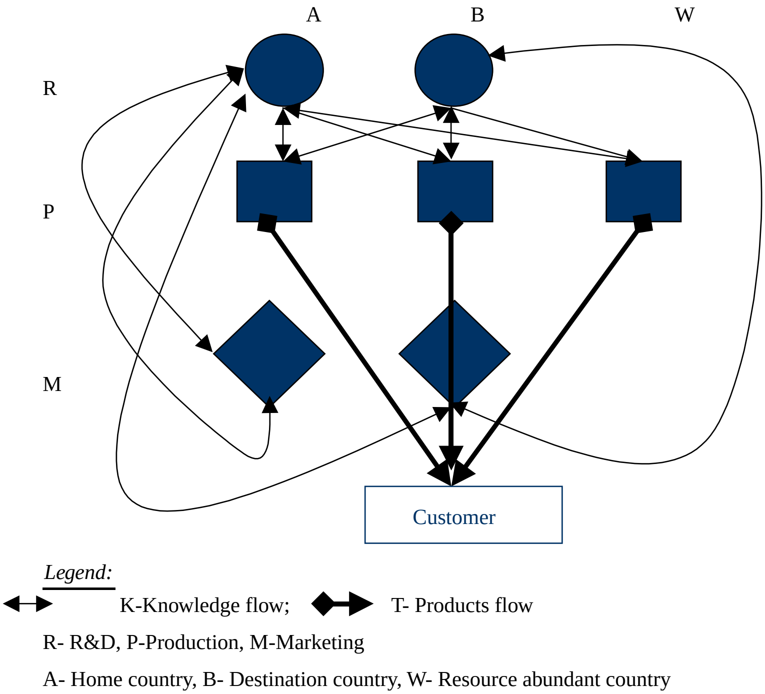

Fig. 1. Alternative locations of value-adding activities. *K*, Knowledge flow; *T*, products flow. *R*, R&D, *P*, production; *M*, marketing. A, Home country, B, destination country, W, resource-abundant country.

denoted by thin lines. An arrow indicates the direction of flow. Three main types of linkage are identified: $K_{R–P}$, flow of knowledge from R&D to production and vice versa, $K_{M–R}$, flow of knowledge from marketing to R&D and vice versa, and $T_{i–j}$ ($i,j = $ A, B, W; $i \neq j$), flow of products from the production plant to the market. Product flow is one-way, but knowledge flows are two-way. This is because there is always feedback in knowledge flows between different value-adding activities.

$K_{R–P}$ includes details on the product design and manufacturing instructions. $K_{M–R}$ enables state of the art know-how to be transferred to the marketing personnel, as well as getting market feedback from the market regarding product design and competitors' technology. There is no flow of knowledge between the production and marketing; the transmission of knowledge between these two entities is entirely intermediated by R&D. This simplification implies that the market feedback is processed in the R&D laboratory before it is implemented in production, and that the R&D personnel have to approve product specifications before they are transferred to the marketing people.

Based on the set of location possibilities detailed in Fig. 1, it is possible to formulate the control decision of the firm over each of its value-adding activities. We include two modes of control:

(a) *Internalisation*— Operating a value-adding activity within the boundaries of the firm.
(b) *Externalisation*— Operating a value-adding activity outside the firms' boundaries through arms length transactions, licensing or outsourcing.

We ignore externalisation of local value-adding activities, as this is not part of this paper's main focus. Hence the firm's decision whether to internalise or externalise a value-adding activity is narrowed down to R&D (in B), production (in B and/or W) and marketing (in B).

Adding the control decision to the location decision, discussed earlier, naturally increases the number of alternatives faced by the internationalising firm. In sum, there are 45 alternative configurations. Table 1 details the possible set of configurations. For each of the 12 location alternatives (numbered 1–12), the relevant control alternatives are specified (denoted, for

Table 1
Alternative firm configurations

No.	R&D	Knowledge flow R&D-production	Production	Transportation to customers	Marketing	Knowledge flow market-ing—R&D
1	R_{A}	$K_{RA–PA}$	P_{A}	$T_{A–B}$	M_{A}	$K_{MA–RA}$
2	R_{A}	$K_{RA–PB}$	P_{B}	$T_{B–B}$	M_{A}	$K_{MA–RA}$
2a	R_{A}	$K_{RA–PB–ex}$	$P_{B–ex}$	$T_{B–B}$	M_{A}	$K_{MA–RA}$
3	R_{A}	$K_{RA–PW}$	P_{W}	$T_{W–B}$	M_{A}	$K_{MA–RA}$
3a	R_{A}	$K_{RA–PW–ex}$	$P_{W–ex}$	$T_{W–B}$	M_{A}	$K_{MA–RA}$
4	R_{A}	$K_{RA–PA}$	P_{A}	$T_{A–B}$	M_{B}	$K_{MB–RA}$
4a	R_{A}	$K_{RA–PA}$	P_{A}	$T_{A–B}$	$M_{B–ex}$	$K_{MB–ex–RA}$
5	R_{A}	$K_{RA–PB}$	P_{B}	$T_{B–B}$	M_{B}	$K_{MB–RA}$
5a	R_{A}	$K_{RA–PB–ex}$	$P_{B–ex}$	$T_{B–B}$	M_{B}	$K_{MB–RA}$
5b	R_{A}	$K_{RA–PB}$	P_{B}	$T_{B–B}$	$M_{B–ex}$	$K_{MB–ex–RA}$
5c	R_{A}	$K_{RA–PB–ex}$	$P_{B–ex}$	$T_{B–B}$	$M_{B–ex}$	$K_{MB–ex–RA}$
6	R_{A}	$K_{RA–PW}$	P_{W}	$T_{W–B}$	M_{B}	$K_{MB–RA}$
6a	R_{A}	$K_{RA–PW–ex}$	$P_{W–ex}$	$T_{W–B}$	M_{B}	$K_{MB–RA}$
6b	R_{A}	$K_{RA–PW–ex}$	$P_{W–ex}$	$T_{W–B}$	$M_{B–ex}$	$K_{MB–ex–RA}$
6c	R_{A}	$K_{RA–PW}$	P_{W}	$T_{W–B}$	$M_{B–ex}$	$K_{MB–ex–RA}$
7	R_{B}	$K_{RB–PA}$	P_{A}	$T_{A–B}$	M_{A}	$K_{MA–RB}$
7a	$R_{B–ex}$	$K_{RB—ex–PA}$	P_{A}	$T_{A–B}$	M_{A}	$K_{MA–RB–ex}$
8	R_{B}	$K_{RB–PB}$	P_{B}	$T_{B–B}$	M_{A}	$K_{MA–RB}$
8a	R_{B}	$K_{RB–PB–ex}$	$P_{B–ex}$	$T_{B–B}$	M_{A}	$K_{MA–RB}$
8b	$R_{B–ex}$	$K_{RB–ex–PB}$	P_{B}	$T_{B–B}$	M_{A}	$K_{MA–RB–ex}$
8c	$R_{B–ex}$	$K_{RB–ex–PB–ex}$	$P_{B–ex}$	$T_{B–B}$	M_{A}	$K_{MA–RB–ex}$
9	R_{B}	$K_{RB–PW}$	P_{W}	$T_{W–B}$	M_{A}	$K_{MA–RB}$
9a	R_{B}	$K_{RB–PW–ex}$	$P_{W–ex}$	$T_{W–B}$	M_{A}	$K_{MA–RB}$
9b	$R_{B–ex}$	$K_{RB–ex–PW}$	P_{W}	$T_{W–B}$	M_{A}	$K_{MA–RB–ex}$
9c	$R_{B–ex}$	$K_{RB–ex–PW–ex}$	$P_{W–ex}$	$T_{W–B}$	M_{A}	$K_{MA–RB–ex}$
10	R_{B}	$K_{RB–PA}$	P_{A}	$T_{A–B}$	M_{B}	$K_{MB–RB}$
10a	R_{B}	$K_{RB–PA}$	P_{A}	$T_{A–B}$	$M_{B–ex}$	$K_{MB–ex–RB}$
10b	$R_{B–ex}$	$K_{RB–ex–PA}$	P_{A}	$T_{A–B}$	M_{B}	$K_{MB–RB–ex}$
10c	$R_{B–ex}$	$K_{RB–PA}$	P_{A}	$T_{A–B}$	$M_{B–ex}$	$K_{MB–ex–RB–ex}$
11	R_{B}	$K_{RB–ex–PB}$	P_{B}	$T_{B–B}$	M_{B}	$K_{MB–RB}$
11a	R_{B}	$K_{RB–PB–ex}$	$P_{B–ex}$	$T_{B–B}$	M_{B}	$K_{MB–RB}$
11b	R_{B}	$K_{RB–PB}$	P_{B}	$T_{B–B}$	$M_{B–ex}$	$K_{MB–ex–RB}$
11c	R_{B}	$K_{RB–PB–ex}$	$P_{B–ex}$	$T_{B–B}$	$M_{B–ex}$	$K_{MB–ex–RB}$
11d	$R_{B–ex}$	$K_{RB–ex–PB}$	P_{B}	$T_{B–B}$	M_{B}	$K_{MB–RB–ex}$
11e	$R_{B–ex}$	$K_{RB–ex–PB–ex}$	$P_{B–ex}$	$T_{B–B}$	M_{B}	$K_{MB–RB–ex}$
11f	$R_{B–ex}$	$K_{RB–ex–PB}$	P_{B}	$T_{B–B}$	$M_{B–ex}$	$K_{MB–ex–RB–ex}$
12d	$R_{B–ex}$	$K_{RB–ex–PW}$	P_{W}	$T_{W–B}$	M_{B}	$K_{MB–RB–ex}$
12e	$R_{B–ex}$	$K_{RB–ex–PW–ex}$	$P_{W–ex}$	$T_{W–B}$	M_{B}	$K_{MB–RB–ex}$
12f	$R_{B–ex}$	$K_{RB–ex–PW–ex}$	$P_{W–ex}$	$T_{W–B}$	$M_{B–ex}$	$K_{MB–ex–RB–ex}$
12 g	$R_{B–ex}$	$K_{RB–ex–PW}$	P_{W}	$T_{W–B}$	$M_{B–ex}$	$K_{MB–ex–RB–ex}$

instance, as '12a', '12b', '12c', etc.). The sign 'ex' is used to indicate a value-adding activity that is externalised. We denote the location of a value-adding activity (R, P, M) by its sign and the country symbol (A, B, W). Knowledge flows between two value-adding activities are denoted by 'K' and the symbols of the relevant activities (for instance, $K_{\mathrm{RA-PB-ex}}$ indicates knowledge flows from the R&D laboratory in A to the externalised production site in B). Product flows are denoted by 'T' and the symbols of origin and destination countries (for instance, $T_{\mathrm{A-B}}$ indicates product flow from country A to country B). Hence, Table 1 includes the location of R, P and M operations for each alternative, an indication whether these activities are externalised or not and the specification of the relevant knowledge and product flows.

3.2. Flow costs

Next, we define the costs of value-adding activities and flows. For convenience, the denotations used in Table 1 also represent the cost of the relevant value-adding activities and flows.

3.2.1. Product flows

Product flow costs (T) include the cost of transportation, tariffs and non-tariff barriers (Hirsch, 1976). These costs are referred to as 'transportation costs'. We assume that international transportation costs are higher than local ones (Helpman & Krugman, 1985; Hirsch, 1976; Hirsch & Hashai, 2000; Krugman, 1991, 1995). Thus, we determine that:

$$T_{\mathrm{local}} < T_{\mathrm{international}}. \tag{1a}$$

For the sake of simplicity, we assume that the international product flow costs are identical between A, B and W. Thus, we can define the difference between local and international flows as:

$$\Delta T = T_{\mathrm{local}} - T_{\mathrm{international}}.$$

We also assume that:

$$T_{\mathrm{external}} = T_{\mathrm{internal}} \tag{1b}$$

This is because the main cost that is captured by T is the products' transportation costs. Additional costs such as the costs of controlling the transportation of products to customers, costs of delays in supply and faults in shipped goods are expected to be negligible in comparison to the transportation cost.

3.2.2. Knowledge flows

Knowledge flow costs (K) include formal as well as informal firm-specific knowledge that flows between the firm's value-adding activities (Buckley & Carter, 2004; Casson, 2000; Hirsch, 1976; Kogut & Zander, 1993; Martin & Salomon, 2003).

We assume that:

$$K_{\mathrm{local}} < K_{\mathrm{international}} \tag{2a}$$

As recently noted by Buckley and Carter (2004), international knowledge flow costs are higher than the local knowledge flow costs, because of the greater complexity of control (Hirsch, 1976), cultural differences (Hofstede, 1980; Kogut & Singh, 1988) and language differences (Rangan & Adner, 2001).

For the sake of simplicity, we assume that the differences in international knowledge flow costs are identical between A, B and W. Thus, the difference between local and international knowledge flows is defined as:

$$\Delta K = K_{\text{local}} - K_{\text{international}}.$$

Knowledge flow costs are assumed to be more expensive when an external value-adding activity is involved. The reason for this is the need to control external activities, disinformation that might occur in the process, and the costs of dishonesty and opportunism. The flow of knowledge between an internal and external value-adding activity is more exposed to mistakes and disinformation in comparison to an internal knowledge flow, while the knowledge flow between two external value-adding activities is even more costly for the firm (Anderson & Gatignon, 1986; Buckley & Casson, 1976, 1979; Dunning, 1977, 1988, 2000; Hirsch, 1976; Kogut & Zander, 1993; Martin & Salomon, 2003; Rugman, 1981; Williamson, 1975, 1985). We therefore assume that

$$K_{\text{internal–internal}} < K_{\text{internal–external}} < K_{\text{external–external}}, \tag{2b}$$

and that the cost difference between these terms is equal and denoted by:

$$\Delta K' = K_{\text{internal–internal}} - K_{\text{internal–external}} = K_{\text{internal–external}} - K_{\text{external–external}}.$$

3.3. Operation costs

3.3.1. R&D

The output of an R&D laboratory can be transferred (via $K_{\text{R–P}}$) to production sites at A, B and W. In addition, there is an extensive flow of know-how between the marketing entity and R&D laboratory (via $K_{\text{M–R}}$).

We assume that:

$$R_{\text{A}} < R_{\text{B}} \tag{3a}$$

The fact that a firm's knowledge resources are often based on its home country implies that the operation of R&D will probably be cheaper at the home country. This is consistent with Hirsch's view of the creation of firm-specific proprietary know-how (Hirsch, 1976) and with other studies that identified specific home country advantages in the location of R&D (Dunning, 1988; Patel & Pavitt, 1991; Pearce & Papanastassiou, 1996). These costs advantages are reinforced by the costs stemming from the liability of foreignness (Hymer, 1976) in operating in B as well as the superior information links and knowledge exchange that a firm is expected to have with Universities and government authorities in its home country. We denote: $\Delta R = R_{\text{B}} - R_{\text{A}}$ as the difference between the R&D cost in A and B.

Nevertheless, according to (2a), savings on knowledge flow costs facilitate cost advantages in locating the R&D laboratory abroad in proximity to foreign production or to marketing activities (Patel & Vega, 1999; Pearce & Papanastassiou, 1996). Hence, the final decision concerning location would be the outcome of the comparative costs of operations (R, P and M) and knowledge flow costs.

While the cost of R&D activities in B is expected to exceed that of R&D activities in A, externalisation of R&D activities in B may decrease this cost differential. An externalised R&D laboratory is expected to be cheaper than an internalised one, because of savings on once-and-for-all set up costs and savings on fixed costs. Indigenous partners in B may use their existing

R&D laboratories in B and thus enjoy economies of scale and scope in generating knowledge, thus enjoying a cost advantage over a newly established (or acquired) R&D lab (Narula & Dunning, 1998). These costs advantages are even greater if one considers the impact of cultural distance (Hofstede, 1980; Kogut & Singh, 1988) that again give advantages to indigenous partners from B over the A firm in its relations with the local universities and government in B. We therefore assume that

$$R_{\text{B-ex}} < R_{\text{B}} \tag{3b}$$

where $R_{\text{B-ex}}$ denotes an external R&D laboratory and R_{B} denotes an internal one. The cost difference between internal and external R&D activities is denoted by $\Delta R' = R_{\text{B-ex}} - R_{\text{B}}$.

3.3.2. Production

Production costs are assumed to be cheapest at W. W is assumed to be comparatively endowed with production inputs compared to A and B. For example, W may be a labour-abundant developing country with cheaper labour costs than A or B. It is also assumed that production in the home country is cheaper than production in the destination country. This assumption stems from the liability of foreignness (Hymer, 1976) as well as the superior information links and connections a firm is supposed to have with suppliers, government authorities and other institutions in its home country (Buckley & Casson, 1976; Casson, 1994; Kogut & Singh, 1988; Mariotti & Piscitello, 1995). Thus we assume that:

$$P_{\text{W}} < P_{\text{A}} < P_{\text{B}} \tag{4a}$$

We denote the differences between these production costs as: $\Delta P = P_i - P_j$, ($i, j = \text{A, B, W}$, $i \neq j$). For the sake of simplicity, we assume that the production cost differential is equal between each pair of countries: $\Delta P_{\text{B-A}} = \Delta P_{\text{A-W}}$. Inequality (4a) implies that the cost differential between P_{B} and P_{W} is twice as much as the cost differential between P_{A} and P_{W}, hence: $\Delta P_{\text{B-W}} = 2 \times \Delta P_{\text{A-W}}$.

We assume that external execution of international production (in B or W) is cheaper than producing internally. The reason for this is that an external operation usually does not require the large investment necessary to establish a production facility, because the indigenous partner/subcontractor in the destination country may leverage on existing plants and production lines. For the same reason, an indigenous partner may save some of the fixed costs of production, thus enabling manufacture at a lower cost. Moreover, the liability of foreignness and cultural distance (Hofstede, 1980; Hymer, 1976; Kogut & Singh, 1988; Mariotti & Piscitello, 1995) again gives an advantage to indigenous partners/subcontractors (from B or W) over firm A in bargaining power and connections with local suppliers and government. We therefore assume that

$$P_{i\text{-ex}} < P_i \quad (i = \text{B, W}) \tag{4b}$$

where $P_{i\text{-ex}}$ denotes external production and P_i denotes internal production. The cost difference between internal and external production is denoted by $\Delta P' = P_{i\text{-ex}} - P_i$ ($i = \text{B, W}$).

3.3.3. Marketing

The costs of marketing are assumed to be lower in the destination country, in comparison with the home country:

$$M_{\text{B}} < M_{\text{A}} \tag{5a}$$

The fact that maintaining a marketing force (sales and post-sale services personnel) abroad involves additional costs that may be avoided in the home country (e.g. renting of additional offices and expatriate worker costs), proximity of marketing to the firm's customers, is assumed to be of much greater importance if the firm has to serve a large mass of customers (Hirsch, 1989). The savings on promotion costs, on sales persons' and technicians' travelling costs, on distribution control costs and on transportation of spare parts, together with the quick response to customer needs and the ability to collect data on market trends in a much more efficient way, are all part of the explanation why it is cheaper to locate marketing activities in the destination market (Almor & Hirsch, 1995; Hirsch, 1989). We denote $\Delta M = M_A - M_B$ as the difference between marketing activities costs in A and B.

The cost of external operation of marketing in B is assumed to be lower than the internal operation. This assumption stems from the high fixed costs required to establish a marketing infrastructure that is able to market the product and provide after-sale services abroad. Indigenous firms that are well acquainted with the market and have already established their marketing infrastructure may save these costs. Moreover, the liability of foreignness is even more significant in marketing than in production: cultural and economic differences (Contractor, 1990; Hofstede, 1980; Kogut & Singh, 1988; Linder, 1961), accessibility to distribution channels, connection with the media and government authorities—are all crucial factors that give the indigenous marketing entity an advantage over a foreign one. Thus we assume that

$$M_{B-ex} < M_B \tag{5b}$$

where M_{B-ex} denotes an external marketing operation and M_B denotes the internal one. The cost difference between internal and external marketing operation is denoted by $\Delta M' = M_{B-ex} - M_B$.

4. Solution of the location and control decisions

We expect the internationalising firm to choose the configuration with the lowest overall cost. The overall cost of each configuration can be calculated by summing the costs of each value-adding activity, together with the relevant product and knowledge flow costs. Which configuration will be chosen depends on the relative magnitude of costs. The easiest way to understand the general properties of the solution is first to eliminate any configuration that is clearly dominated by another. Then we compare the remaining configurations in terms of the major trade-offs involved and their magnitude. This is done by comparing the costs of 12 location alternatives and then evaluating for each location alternative the cost of internal versus external operations.

4.1. The location decision

Based on inequalities (1)–(5), configurations 7–10 are dominated by others. Configuration 7, for instance, is dominated by configuration 1. These configurations differ only in the location of R&D laboratory. In configuration 1, R&D is located in A and in configuration 7, it is located in B. The location of R&D in A is cheaper than in B (inequality (3a)) and also implies cheaper knowledge flow costs between R, P and M since only local knowledge flows are involved (inequality (2a)). Likewise, it can be shown that configuration 7a is also dominated by configuration 1, configurations 8, 8a, 8b and 8c are dominated by configurations 11, 11a, 11d and 11e, respectively, configurations 9 and 9b are dominated by configuration 3, configurations 9a and 9c are dominated by configuration 3a, and configurations 10, 10a, 10b and 10c are

Table 2
Decision criteria between location configurations

Configuration No.	Selection Criteria	Notes
1	**Ra, Pa, Ma**	
2	$\Delta K_{R-P} + \Delta P > \Delta T$	
3	$\Delta K_{R-P} > \Delta P$	
4	$\Delta K_{M-R} > \Delta M$	
5	$\Delta K_{R-P} + \Delta P + \Delta K_{M-R} > \Delta T + \Delta M$	result of 2 & 4
6	$\Delta K_{R-P} + \Delta K_{M-R} > \Delta P + \Delta M$	result of 3 & 4
11	$\Delta R + \Delta P > \Delta T + \Delta M$	
12	$2\Delta K_{R-P} + \Delta R > \Delta P + \Delta M$	
	Necessary condition:	$3\Delta K_{R-P} + \Delta K_{M-R} + 2\Delta R > 2\Delta T + 3\Delta M$
2	**Ra, Pb, Ma**	
1	$\Delta T > \Delta K_{R-P} + \Delta P$	
3	$\Delta T > 2\Delta P$	
4	$\Delta T + \Delta K_{M-R} > \Delta K_{R-P} + \Delta P + \Delta M$	result of 1 & 5
5	$\Delta K_{M-R} > \Delta M$	
6	$\Delta K_{M-R} + \Delta T > \Delta M + 2\Delta P$	result of 3 & 5
11	$\Delta R > \Delta K_{R-P} + \Delta M$	
12	$\Delta R + \Delta T > 2\Delta P + \Delta M$	result of 3 & 11
	Necessary condition:	$\Delta K_{M-R} + 2\Delta T + \Delta R > 2\Delta K_{R-P} + 3\Delta P + 2\Delta M$
3	**Ra, Pw, Ma**	
1	$\Delta P > \Delta K_{R-P}$	
2	$2\Delta P > \Delta T$	
4	$\Delta P + \Delta K_{M-R} > \Delta K_{R-P} + \Delta M$	result of 1 & 6
5	$2\Delta P + \Delta K_{M-R} > \Delta T + \Delta M$	result of 2 & 6
6	$\Delta K_{M-R} > \Delta M$	
11	$\Delta R + 2\Delta P > \Delta K_{R-P} + \Delta T + \Delta M$	
12	$\Delta R > \Delta M$	
	Necessary condition:	$2\Delta R + \Delta K_{M-R} + 5\Delta P > 2\Delta K_{R-P} + 2\Delta T + 3\Delta M$
4	**Ra, Pa, Mb**	
1	$\Delta M > \Delta K_{M-R}$	
2	$\Delta K_{R-P} + \Delta P + \Delta M > \Delta T + \Delta K_{M-R}$	result of 1 & 5
3	$\Delta K_{R-P} + \Delta M > \Delta P + \Delta K_{M-R}$	result of 1 & 6
5	$\Delta K_{R-P} + \Delta P > \Delta T$	
6	$\Delta K_{R-P} > \Delta P$	
11	$\Delta R + \Delta P > \Delta K_{M-R} + \Delta T$	
12	$\Delta R + \Delta K_{R-P} > \Delta K_{M-R} + \Delta P$	
	Necessary condition:	$\Delta M + 3\Delta K_{R-P} + 2\Delta R > 3\Delta K_{M-R} + 2\Delta T$

Table 2 (*continued*)

Configuration No.	Selection Criteria	Notes
5	**Ra, Pb, Mb**	
1	$\Delta T + \Delta M > \Delta K_{R\text{-}P} + \Delta P + \Delta K_{M\text{-}R}$	result of 2 & 4
2	$\Delta M > \Delta K_{M\text{-}R}$	
3	$\Delta T + \Delta M > 2\Delta P + \Delta K_{M\text{-}R}$	result of 2 & 6
4	$\Delta T > \Delta K_{R\text{-}P} + \Delta P$	
6	$\Delta T > 2\Delta P$	
11	$\Delta R > \Delta K_{R\text{-}P} + \Delta K_{M\text{-}R}$	
12	$\Delta R + \Delta T > \Delta K_{M\text{-}R} + 2\Delta P$	result of 6 & 11
	Necessary condition: $\Delta M + 3\Delta T + 2\Delta R > 2\Delta K_{R\text{-}P} + 3\Delta K_{M\text{-}R} + 5\Delta P$	
6	**Ra, Pw, Mb**	
1	$\Delta P + \Delta M > \Delta K_{R\text{-}P} + \Delta K_{M\text{-}R}$	result of 3 & 4
2	$\Delta M + 2\Delta P > \Delta K_{M\text{-}R} + \Delta T$	result of 3 & 5
3	$\Delta M > \Delta K_{M\text{-}R}$	
4	$\Delta P > \Delta K_{R\text{-}P}$	
5	$2\Delta P > \Delta T$	
11	$\Delta R + 2\Delta P > \Delta T + \Delta K_{R\text{-}P} + \Delta K_{M\text{-}R}$	
12	$\Delta R > \Delta K_{M\text{-}R}$	
	Necessary condition: $\Delta M + 5\Delta P + 2\Delta R > 2\Delta K_{R\text{-}P} + 2\Delta T + 3\Delta K_{M\text{-}R}$	
11	**Rb, Pb, Mb**	
1	$\Delta T + \Delta M > \Delta R + \Delta P$	
2	$\Delta K_{R\text{-}P} + \Delta M > \Delta R$	
3	$\Delta K_{R\text{-}P} + \Delta T + \Delta M > \Delta R + 2\Delta P$	
4	$\Delta K_{M\text{-}R} + \Delta T > \Delta R + \Delta P$	
5	$\Delta K_{R\text{-}P} + \Delta K_{M\text{-}R} > \Delta R$	
6	$\Delta T + \Delta K_{R\text{-}P} + \Delta K_{M\text{-}R} > \Delta R + 2\Delta P$	
12	$\Delta T + \Delta K_{R\text{-}P} > 2\Delta P$	
	Necessary condition: $5\Delta K_{R\text{-}P} + 5\Delta T + 3\Delta K_{M\text{-}R} + 3\Delta M > 8\Delta P + 6\Delta R$	
12	**Rb, Pw, Mb**	
1	$\Delta P + \Delta M > \Delta K_{R\text{-}P} + \Delta R$	
2	$2\Delta P + \Delta M > \Delta R + \Delta T$	result of 3 & 11
3	$\Delta M > \Delta R$	
4	$\Delta K_{M\text{-}R} + \Delta P > \Delta R + \Delta K_{R\text{-}P}$	result of 6 & 11
5	$\Delta K_{M\text{-}R} + 2\Delta P > \Delta R + \Delta T$	result of 6 & 11
6	$\Delta K_{M\text{-}R} > \Delta R$	
11	$2\Delta P > \Delta T + \Delta K_{R\text{-}P}$	
	Necessary condition: $3\Delta P + \Delta K_{M\text{-}R} + 2\Delta M > 3\Delta R + \Delta T + 6\Delta K_{R\text{-}P}$	

dominated by configurations 12, 12a, 12d and 12e, respectively. The dominated configurations are denoted with italics in Table 1.

Thus, we are left with 31 configurations, representing eight location configurations. Table 2 presents a set of necessary and sufficient conditions for the selection of each of the eight location configurations as the preferred one. This set of necessary and sufficient conditions enables us to compare the eight location configurations according to the specific product attributes and to choose the configuration that minimises overall costs.

The interpretation of Table 2 is as follows. Configuration 1 is the preferred configuration of an internationalising firm if *all* the inequalities, specified under configuration 1, exist. For example if $\Delta K_{R-P}+\Delta P>\Delta T$, configuration 1 ($R$, P and M located at A) will be preferred over configuration 2 (R and M located at A, P located at B) since the cost of knowledge flows between R and P and the extra cost of producing in B is higher than the savings on transportation (product flow) costs that result from the comparative proximity of the plant in B to the market. Configuration 1 is preferred over configuration 3 if $\Delta K_{R-P}>\Delta P$, and so on. Thus, per each location configuration, Table 2 details the set of inequalities that should exist for the specific location configuration to be the least cost one.

Although we cannot present a single term that identifies the superiority of a given configuration, i.e. satisfies the necessary and sufficient conditions to select it, we can introduce a single term that specifies the *necessary* condition to select a configuration, as detailed in the *final row* of the cost comparison of each configuration.

The necessary condition can be calculated as the sum of the inequalities that constitute the set of necessary and sufficient conditions to select a given configuration. The mathematical reasoning of this is straightforward. If the terms α, β, γ and δ fulfil the following relations

$$\alpha>\beta \tag{6a}$$

and

$$\gamma>\delta \tag{6b}$$

then it implies that

$$\alpha+\gamma>\beta+\delta \tag{6c}$$

Following inequalities (1)–(5) and as indicated in the 'Notes' column of Table 2, some inequalities are implied by others (for example, if configuration 1 is preferred over configurations 2 and 4, it is preferential to configuration 5 as well). Hence, we do not need to sum all the inequalities, but only those that are 'stand-alone' (i.e. are not results of other inequalities).

The necessary condition is a single inequality that assures us that a specific configuration dominates all others. For example if $3\Delta K_{R-P}+\Delta K_{M-R}+2\Delta R>2\Delta T+4\Delta M$, configuration 1 will dominate all other configurations. The savings on knowledge cost flows (both K_{R-P} and K_{M-R}), together with the relatively cheap cost of R_A will be higher than the additional cost that results from transportation to the market in B, and location of M in A rather than in B.

The necessary condition enables us to speculate on the location configurations of firms with different product attributes. The basic logic of these speculations is that if a certain cost variable (R, P, M, K_{R-P}, K_{M-R} or T) has higher values in products with specific attributes, the cost difference of these variables is also expected to be higher. This observation is intuitively reasonable and stems from the following mathematical conventions:

$$\text{if } \alpha \to \infty \text{ and } \beta \to \infty \text{ then } (\alpha - \beta) \to \infty \tag{7a}$$

$$\text{if } \alpha \to 0 \text{ and } \beta \to 0 \text{ then } (\alpha - \beta) \to 0 \tag{7b}$$

For example, as High Technology (HT) products are more knowledge-intensive than Low Technology (LT) products, we expect that R, $K_{\text{R–P}}$, $K_{\text{M–R}}$ and M are higher in HT products compared to LT ones (Almor & Hirsch, 1995; Buckley & Casson, 1976; DuBois, Toyne, & Oliff, 1993; Hirsch, 1989; Kogut & Zander, 1993; Martin & Salomon, 2003). The fact that R, $K_{\text{R–P}}$ and $K_{\text{M–R}}$ are relatively higher in HT products implies that their cost difference is also probably relatively higher. Thus, whenever a high value of these terms is required in order to satisfy the necessary condition of a location configuration (e.g. configurations 1 and 4), they are likely to be chosen by HT firms. One interesting implication of this observation is that the choice of configurations 1 and 4 for producers of HT products does not depend on production costs at all, as opposed to the view of many scholars (e.g. DuBois et al., 1993; Dunning, 1977, 1988, 2000; Hirsch, 1976; Kotabe & Swan, 1994).

Another example applies to producers of intangible products (which have negligible transportation costs) that do not require intensive marketing interactions with their customers, as they are fairly standard (Hirsch, 1989). Such products might be, for instance, standard (ready-made) software packages or computer games. Since M and T are assumed to be low in these products, we expect ΔM and ΔT to be relatively low as well (e.g. *as opposed* to location configuration 5). Producers of standard intangible products are therefore expected to select location configurations that require high values of ΔM and ΔT less frequently than producers of other products.

Finally, Table 2 enables us to specify the necessary conditions for the emergence of 'knowledge asset seeking' FDI in the host country (Dunning & Narula, 1995). This is expected to occur when either configuration 11 or configuration 12 are the preferred location configuration (since both configurations imply the location of R&D activities in B). Essentially, in the case where production is located in B (configuration 11), knowledge asset seeking FDI is expected to occur when the savings on knowledge flow between R&D and production and transportation costs exceed the extra costs of production and R&D in B. On the other hand, in the case where production is located in W (configuration 12) knowledge asset seeking FDI is expected to occur when the savings on production costs exceed the extra costs of R&D in B, transportation from W to B and knowledge flow between R&D and production.

4.2. The control decision

Having defined the set of necessary and sufficient conditions to select a location configuration, we can now elaborate the decision rules and compare between internal and external modes of control. Inequalities (1b), (2b), (3b), (4b) and (5b) imply that:

Configurations 2a, 3a, 5a, 6a, 11a and 12a are preferential to configurations 2, 3, 5, 6, 11 and 12, respectively, in cases where the savings on external foreign production are higher than the savings on internal knowledge flows between R&D and production, i.e. if:

$$\Delta P\prime > \Delta K'_{\text{R–P}} \tag{8a}$$

Configurations 4a, 5b, 6c, 11b and 12c are preferential to configurations 4, 5, 6, 11 and 12, respectively, in cases where the savings on external foreign marketing operations are higher than the savings on internal knowledge flows between marketing and R&D, i.e. if:

$$\Delta M\imath > \Delta K'_{\mathrm{M-R}} \tag{8b}$$

Configurations 5c, 6b, 11c and 12b are preferential to configurations 5, 6, 11 and 12, respectively, in cases where the cumulative savings on external foreign production and marketing operations are higher than the cumulative savings on internal knowledge flows between R&D and production and between marketing and R&D, i.e. if:

$$\Delta P\imath + \Delta M\imath > \Delta K'_{\mathrm{R-P}} + \Delta K'_{\mathrm{M-R}} \tag{8c}$$

Configurations 11d and 12d are preferential to configurations 11 and 12, respectively, in cases where the savings on external foreign R&D activities are higher than the cumulative savings on internal knowledge flows between R&D and production and between marketing and R&D, i.e. if:

$$\Delta R\imath > \Delta K'_{\mathrm{R-P}} + \Delta K'_{\mathrm{M-R}} \tag{8d}$$

Configurations 11e and 12e are preferential to configurations 11 and 12, respectively, in cases where the cumulative savings on external foreign R&D and production are higher than the cumulative savings on internal knowledge flows between R&D and production and between marketing and R&D, or more specifically if:

$$\Delta R\imath + \Delta P\imath > 2\Delta K'_{\mathrm{R-P}} + \Delta K'_{\mathrm{M-R}} \tag{8e}$$

Configurations 11f and 12f are preferential to configurations 11 and 12, respectively, in cases where the cumulative savings on external foreign R&D and marketing operations are higher than the cumulative savings on internal knowledge flows between R&D and production and between marketing and R&D, or more specifically if:

$$\Delta R\imath + \Delta M\imath > \Delta K'_{\mathrm{R-P}} + 2\Delta K'_{\mathrm{M-R}} \tag{8f}$$

Configurations 11 g and 12 g are preferential to configurations 11 and 12, respectively, in cases where the cumulative savings on external foreign R&D, production and marketing operations are higher than the cumulative savings on internal knowledge flows between R&D and production and between marketing and R&D, or more specifically if:

$$\Delta R\imath + \Delta P\imath + \Delta M\imath > 2\Delta K'_{\mathrm{R-P}} + 2\Delta K'_{\mathrm{M-R}} \tag{8g}$$

Inequalities (8a)–(8f) imply under which conditions externalisation of R&D, production and marketing activities is preferred over internalisation of these value-adding activities. Moreover, following the reasoning presented in inequalities (6a)–(6c) regarding the preference of certain location configurations over others, we can deduce that inequality (8 g) that sums inequalities (8a)–(8f) serves as the *necessary* condition to prefer externalisation to internalisation, since this inequality has to exist for inequalities (8a)–(8f) to exist[1].

We can now articulate additional expectations regarding the internalisation and externalisation preferences of firms with different product attributes. For instance, as knowledge cost flows are expected to be higher in HT products than in LT products (DuBois et al., 1993; Hirsch, 1976; Kogut & Zander, 1993; Martin & Salomon, 2003), we anticipate their cost

[1] Still inequality (8 g) does not guarantee the existence of all other inequalities and this is why it cannot serve as the necessary and sufficient condition for the control decision.

differential to be higher as well, and thus producers of HT products are expected to have a greater tendency to internalise value-adding activities than producers of LT products.

For intangible products (e.g. software), per unit production costs are negligible compared to knowledge flow costs, implying that knowledge flow cost differences are probably higher than production costs ones. This implies, for instance, that configurations 2, 3, 5, 6, 11 and 12 are expected to be costlier than configurations 2a, 3a, 5a, 6a, 11a and 12a, respectively, for manufacturers of intangible products. Thus, producers of intangible products are also expected to prefer the configurations that imply internalisation of foreign production activities.

5. A dynamic perspective

The firm's decision regarding its preferred configuration will clearly change over time. We use insights from the product cycle framework (Vernon, 1966) to provide a dynamic extension to the static model discussed earlier. Strictly speaking, the proposed dynamic extension applies only to an internationalising firm that starts out by selling a HT product, which over time (following the familiar product cycle trajectory) is standardized and becomes a LT product.

The product cycle refers to three major phases in the evolution of firm's sales of specific products: introduction, growth and maturity. During these phases, the volume of sales is expected to increase and may be described as an S-shape curve. In order to simplify our discussion, we refer only to two periods of time in the worldwide cycle of a product: *Period 1*—the period where the volume of sales is low but sales are growing rapidly and *Period 2*—the period where the firm faces a substantial market for its product, but sales are not growing fast. Our dynamic extension applies to the expected change in firm configuration between these two periods.

Essentially we argue that the relative cost of each value-adding activity and flow out of the firm's overall costs (i.e. the percentage that this activity or flow cost constitutes out of overall costs) changes between periods 1 and 2. Following Vernon (1966), we assume that the following relationships exist (the numbers 1 and 2 together with the activity/flow cost symbol denote their cost in periods 1 and 2, respectively).

The relative cost of R&D (compared to other value adding activities) is expected to decline over time, since the product becomes standardised:

$$R_1 > R_2 \tag{9}$$

As the number of changes in product specifications reduces, the relative cost of knowledge flows between R and P is expected to reduce as well:

$$(K_{\text{R–P}})_1 > (K_{\text{R–P}})_2 \tag{10}$$

As production volume increases, the relative cost of production is expected to increase compared to other costs (e.g. R&D). Although the absolute per unit production cost may decline, production share in overall costs increases as production runs become longer and the units are more standardised, implying that:

$$P_1 < P_2 \tag{11}$$

The relative cost of transportation is expected to increase too in parallel with the increase in production volumes, as relatively more units will be shipped in period 2 than in period 1:

$$T_1 < T_2 \tag{12}$$

The relative cost of marketing is expected to increase as sales volume increases and competition intensifies:

$$M_1 < M_2 \tag{13}$$

As the number of changes in product specifications and customers' feedback regarding the product (e.g. requests for changes in specifications, fixing bugs) declines, the relative cost of knowledge flows between M and R is expected to decrease:

$$(K_{\mathrm{M-R}})_1 > (K_{\mathrm{M-R}})_2 \tag{14}$$

Inequalities (9)–(14) imply that over time, the relative importance of $K_{\mathrm{R-P}}$, $K_{\mathrm{M-R}}$ and R declines, whereas the relative importance of P, T and M rises. In order to understand how these changes affect the firm's choice of its preferred configuration, we assume that in the long run (i.e. period 2): $K_{\mathrm{R-P}} \to 0$, $K_{\mathrm{M-R}} \to 0$ and $R \to 0$. Following inequality (7b), this means that in the long run: $\Delta K_{\mathrm{R-P}} \to 0$, $\Delta K_{\mathrm{M-R}} \to 0$ and $\Delta R \to 0$. As the relevant costs become negligible, the cost difference between different locations and control modes of R becomes negligible and the cost difference between knowledge flows becomes negligible as well. On the other hand ΔP, ΔT and ΔM are expected to remain constant or to increase.

Applying the above assumptions to the relationships detailed in Table 2 imply that in period 2, configurations that include more value-adding activities that are located outside the home country (A) are expected to dominate others, namely: configurations 6 and 12 dominate configurations 1, 3 and 4 and configurations 5 and 11 dominate configuration 2. This happens because knowledge flow costs become negligible in period 2. We can therefore deduce that the firm's *location* choice, once its product has matured, is limited only to location configurations 5, 6, 11 and 12. While the relationships between these configurations are not clear, it is evident that configurations requiring international knowledge flows become more attractive in period 2, thus firms are expected to increase their international dispersion and locate more value-adding activities outside their home country, over time.

Referring to the necessary conditions that apply to each configuration in Table 2, the fact that $\Delta K_{\mathrm{R-P}} \to 0$, $\Delta K_{\mathrm{M-R}} \to 0$ and $\Delta R \to 0$ implies that the necessary conditions to choose between four remaining configurations, *during period 2*, change as detailed in Table 3.

It can be seen from Table 3 that the choice between location configurations 5, 6, 11 and 12 depends on the magnitude of product flow costs difference (ΔT), production costs difference (ΔP) and marketing costs difference (ΔM). This implies that the long-term location configuration of firms whose product follows the patterns anticipated by the product cycle framework may be predicted based on the product-specific attributes. For instance, we may anticipate that over time distance-sensitive products, i.e. products for which the ratio of per unit transportation costs to per unit production cost is relatively high, incur a larger ΔT than products which are not distance-sensitive (DuBois et al., 1993; Helpman & Krugman, 1985; Hirsch & Hashai, 2000). As high values of ΔT are required in order to satisfy the necessary condition of

Table 3
Necessary conditions for choosing a location configuration (period 2)

Configuration No.	Necessary condition
5	$\Delta M + 3\Delta T > 5\Delta P$
6	$\Delta M + 5\Delta P > 2\Delta T$
11	$6\Delta T + 3\Delta M > 8\Delta P$
12	$3\Delta P + 2\Delta M > \Delta T$

several location configurations (e.g. configurations 5 and 11) in the long run, these configurations are likely to be chosen by firms producing distance-sensitive products.

Incorporating the control *mode* choice into the dynamic extension reveals that during period 2, the factors that favoured internal operation have weakened while the factors favouring external operation have become stronger. The reduction in knowledge flow costs difference compared to production and marketing cost difference indicates that once the firm's product has matured, inequalities (8a)–(8c) as well as (8e)–(8 g) are likely to exist and thus the external operation of M and P will become more economic. This implies that over time, pressures for externalisation increase and internationalising firms are expected to prefer to externalise foreign production and marketing activities. Hence, following our earlier discussion on internal and external operations, during period 2 configurations 5a, 5b and 5c will be preferential to configuration 5; configurations 6a, 6b and 6c will be preferential to configuration 6; configurations 11a, 11b, 11c, 11e, 11f and 11 g will be preferential to configuration 11; and configurations 12a, 12b, 12c, 12e, 12f and 12 g will be preferential to configuration 12.

6. Conclusion

In this paper, we followed the reasoning of 'economic school' of thought to offer a method for the analysis of location and control decisions of internationalising firms. The choice between alternative configurations is captured as a systematic comparison between the costs of value-adding activities and the cost of product and knowledge flows, where the configurations that exhibit the lowest cost are the preferred ones. We have demonstrated the applicability of our approach in a world consisting of three countries and have shown how superior location and control configurations can be identified. Moreover, we were able to considerably shorten the criteria of choice among various location and control configurations by introducing the appropriate sufficient and necessary conditions.

Our proposed model goes beyond classic models adhering to the 'economic school' in several directions. First, the model relates *simultaneously* to a destination country (i.e. the country where the firm's foreign market exists) and a resource-abundant country (i.e. where production is assumed to be the cheapest). This approach enables us to capture a more realistic view of the dilemmas facing internationalising firms than most models of internationalisation that usually relate only to one of the above-mentioned countries or, at best, treat them separately.

Second, we distinguish between the costs of performing specific value-adding activities and the costs of flows. This enables us to get a clearer view of the location and control dilemmas of internationalising firms. In our view, location and control decisions are the outcome of the comparative costs of operations and (mainly knowledge) flows. Operation and flow costs often counteract each other (e.g. when production is cheaper in a specific foreign country, but knowledge flow costs favour proximity of production to R&D, or when externalisation is cheaper but knowledge flows to externalised activities are more expensive). This counter-balancing impact should be considered more specifically as is done in this paper.

Third, we offer a dynamic extension to the firm's internationalisation process based on the economic, rather than the familiar behavioural arguments of the so called stages model of internationalisation (e.g. Calof & Beamish, 1995; Johanson & Vahlne, 1977, 1990; Johanson & Wiedersheim-Paul, 1975). In that respect, our model implies that over time value-adding activities are expected to be not only more internationally dispersed but also more externalised. While this view is consistent with the view of stages model regarding the gradual internationalisation of firms' value-adding activities, it contrasts the stages model which argues that firms internalise their foreign value-adding activities over time.

Fourth, our model places 'knowledge assets seeking' (Dunning & Narula, 1995) within the firm's overall location and control dilemmas and specifies the conditions to internationalise and internalise R&D. By doing this, we integrate the accumulating literature on the internationalisation of R&D (e.g. Cantwell, 1995; Kuemmerle, 1997; Patel & Vega, 1999; Pearce & Papanastassiou, 1996, 1999; Zanfei, 2000) with the basic reasoning of 'economic school' of thought.

Finally, while our model is based on several simplifying assumptions, the model's strength actually lies in the ability to change these assumptions, offer alternative ones and analyse the impact of changing specific assumptions on the model's results. In fact, our model can be modified in many different ways. One modification is to allow duplication of identical value-adding activities across borders. This, of course, complicates the decision making of the firm, as there are then $3\times7\times3=63$ possible location configurations to choose from. Allowing duplication of value-adding activities across borders requires incorporating the impact of returns to scale into the model, which stems from concentration and dispersion of value-adding activities. Additionally, it is possible to modify the model; it also applies to the home market of the internationalising firm, to allow reverse production cost ratios between country A and B (e.g. analyse what happens when production in A is costlier than production in B), to allow the location of R&D and marketing activities in the resource-abundant country (e.g. the location of R&D facilities or Customer Relations Management centres in India or China) or to allow multiple stages of production and thus include the international division of labour in the model. These modifications naturally complicate the model but by using linear programming analysis tools, it should be possible to offer criteria for the solution of these problems as well. Hence, the proposed model may be only the foundation of a new research avenue that may shed light on the interrelations between firms' configurations and internationalisation.

Acknowledgements

Niron Hashai wishes to thank the Recanati Fund at the Hebrew University for its financial support.

References

Almor, T., & Hirsch, S. (1995). Outsiders' response to Europe 1992: Theoretical considerations and empirical evidence. *Journal of International Business Studies*, *26*(2), 223–238.

Anderson, E., & Gatignon, H. (1986). Modes of entry: A transactions cost analysis and propositions. *Journal of International Business Studies*, *17*(3), 1–26.

Buckley, P. J., & Carter, M. J. (2004). A formal analysis of knowledge combination in multinational enterprises. *Journal of International Business Studies*, *35*(5), 371–384.

Buckley, P. J., & Casson, M. (1976). *The future of the multinational enterprise*. London: Macmillan.

Buckley, P. J., & Casson, M. (1979). A theory of international operations. In J. Ghertman, & J. Leontiades (Eds.), *European research in international business*. Amsterdam: North Holland.

Buckley, P. J., & Casson, M. (1998). Analysing foreign market entry strategies: Extending the internalisation approach. *Journal of International Business Studies*, *29*(3), 539–561.

Calof, J. L., & Beamish, P. W. (1995). Adapting to foreign markets: Explaining internationalization. *International Business Review*, *4*(2), 115–131.

Cantwell, J. (1995). The globalisation of technology: What remains of the product cycle model? *Cambridge Journal of Economics*, *19*(1), 155–174.

Casson, M. (1994). Why are firms hierarchical. *International Journal of the Economics of Business*, *1*(1), 47–76.

Casson, M. (2000). *The economics of international business—a new research agenda*. Cheltenham: Edward Elgar.

Contractor, F. J. (1990). Ownership patterns of US joint ventures abroad and the liberalization of foreign government regulation in the 1980's: Evidence from the benchmark surveys. *Journal of International Business Studies*, *21*(1), 55–73.

DuBois, F. L., Toyne, B., & Oliff, M. D. (1993). International manufacturing strategies of US multinationals: A conceptual framework based on four-industry study. *Journal of International Business Studies*, *22*(2), 307–333.

Dunning, J. H. (1977). Trade, location of economic activity and the MNE: A search for an eclectic paradigm. In B. Ohlin, P. O. Hesselborn, & P. M. Wijkman (eds.), *The international allocation of economic activities. Proceedings of a Nobel symposium in Stockholm*. London: Macmillan.

Dunning, J. H. (1988). The eclectic paradigm of international production: A restatement and some possible extensions. *Journal of International Business Studies*, *19*(1), 1–31.

Dunning, J. H. (2000). The eclectic paradigm as an envelope for economic and business theories of MNE activity. *International Business Review*, *9*(2), 163–190.

Dunning, J. H., & Narula, R. (1995). The R&D activities of foreign firms in the United States. *International Studies of Management and Organization*, *25*(1 and 2), 39–73.

Helpman, E., & Krugman, P. R. (1985). *Market structure and foreign trade—Increasing returns, imperfect competition and the international economy*. Cambridge, MA: MIT press.

Hennart, J. F. (1993). Explaining the swollen middle: Why most transactions are a mix of 'market' and 'hierarchy'. *Organization Science*, *4*(4), 529–547.

Hirsch, S. (1976). An international trade and investment theory of the firm. *Oxford Economic Papers*, *28*, 258–270.

Hirsch, S. (1989). Services and service intensity in international trade. *Weltwirtschaffliches Archiv—Review of World Economics*, *125*(1), 45–60.

Hirsch, S., & Hashai, N. (2000). Arab Israeli potential trade: The role of distance sensitive products. *The International Trade Journal*, *14*(1), 1–35.

Hofstede, G. (1980). *Culture's consequences: International differences in work-related values*. Beverley Hills, CA: Sage.

Hymer, S. H. (1976). *The international operations of national firms: A study of direct foreign investment*. 1960 PhD thesis. Cambridge, MA: MIT press.

Johanson, J., & Vahlne, J.-E. (1977). The internationalization process of the firm—A model of knowledge development and increasing foreign market commitment. *Journal of International Business Studies*, *8*(1), 23–32.

Johanson, J., & Vahlne, J.-E. (1990). The mechanism of internationalisation. *International Marketing Review*, *7*(4), 11–24.

Johanson, J., & Wiedersheim-Paul, F. (1975). The internationalisation of the firm—Four Swedish cases. *Journal of Management Studies*, *12*, 305–322.

Kogut, B., & Singh, H. (1988). The effect of country culture on the choice of entry mode. *Journal of International Business Studies*, *19*(3), 411–423.

Kogut, B., & Zander, U. (1993). Knowledge of the firm and the evolutionary theory of the Multinational Corporation. *Journal of International Business Studies*, *24*(4), 625–645.

Kotabe, M., & Swan, S. (1994). Offshore sourcing: Reaction, maturation and consolidation of US multinationals. *Journal of International Business Studies*, *25*(1), 115–140.

Krugman, P. (1991). Increasing returns and economic geography. *Journal of Political Economy*, *99*, 483–499.

Krugman, P. (1995). *Development, geography and economic theory*. MIT Press: Cambridge, MA.

Kuemmerle, W. (1997). Building effective R&D capabilities abroad. *Harvard Business Review*, *March–April*, 61–70.

Kumar, N. (2001). Determinants of location of overseas R&D activities of multinational enterprises: The case of US and Japanese Corporations. *Research Policy*, *30*(1), 159–174.

Linder, S. B. (1961). *An essay on trade and transformation*. New York: Wiley.

Mariotti, S., & Piscitello, L. (1995). Knowledge costs and location of FDI's within the host country: Empirical evidence from Italy. *Journal of International Business Studies*, *26*(4), 815–841.

Martin, X., & Salomon, R. (2003). Knowledge transfer capacity and its implications for the theory of the multinational corporation. *Journal of International Business Studies*, *34*(4), 356–373.

Melin, L. (1992). Internationalization as a strategy process. *Strategic Management Journal*, *13*, 99–118.

Narula, R., & Dunning, J. H. (1998). Explaining international R&D alliances and the role of governments. *International Business Review*, *7*(4), 377–397.

Patel, P., & Pavitt, K. (1991). Large firms in the production of the world's technology: An important case of non-globalisation. *Journal of International Business Studies*, *22*(1), 1–22.

Patel, P., & Vega, M. (1999). Patterns of internationalisation of corporate technology: Location vs. home country advantages. *Research Policy*, *28*(2 and 3), 145–155.

Pearce, R., & Papanastassiou, M. (1996). R&D networks and innovation: Decentralised product development in multinational enterprises. *R&D Management*, *26*(4), 315–333.

Pearce, R., & Papanastassiou, M. (1999). Overseas R&D and the strategic evolution of MNEs: Evidence from laboratories in the UK. *Research Policy*, *28*(1), 23–41.

Rangan, S., & Adner, R. (2001). Profits and the internet: Seven misconceptions. *MIT Sloan Management Review*, *Summer*, 44–53.

Rao, P. M. (2001). The ICT revolution, internationalization of technological activity, and the emerging economies: Implications for global marketing. *International Business Review*, *10*(5), 571–596.

Rugman, A. M. (1981). *Inside the multinationals: The economics of internal markets*. New York: Columbia University Press.

Rugman, A. M. (1986). New theories of the multinational enterprise: An assessment of internalization theory. *Bulletin of Economic Research*, *38*(2), 101–119.

Vernon, R. (1966). International investment and international trade in the product cycle. *Quarterly Journal of Economics*, *80*, 190–207.

Williamson, O. E. (1975). *Markets and hierarchies: Analysis and anti-trust applications*. New York: Free Press.

Williamson, O. E. (1985). *The economic institutions of capitalism*. New York: Free Press.

Zanfei, A. (2000). Transnational firms and changing organization of innovative activities. *Cambridge Journal of Economics*, *24*(5), 515–554.