

PENROSE'S RESOURCE-BASED APPROACH: THE PROCESS AND PRODUCT OF RESEARCH CREATIVITY*

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ABSTRACT

As this paper documents, Edith Tilton Penrose's (1959) classic *The Theory of the Growth of the Firm* is one of the most influential books of the second half of the twentieth century bridging economics and management. Yet, there is little understanding of the process by which this classic came about and the lessons to be learned concerning research creativity. This paper explores Penrose's (1959) 'resources approach' to the growth of the firm as an iterative process of scientific discovery via induction and scientific justification by deductive reasoning. We focus on: (1) the research process that led to Penrose's (1959) classic; (2) the book's contributions to management; (3) the generative nature of Penrose's research for current resource-based theory; and (4) future research building on Penrose's 'resources approach'.

INTRODUCTION

Reproducibility of methods and results, and agreements on rules and criteria are characteristics of (positivist) science. However, critical components in the research process – the hidden face of science – are private, non-reproducible and not bound by official criteria and public rules. While management research spends ample time and attention on the interpersonally comparable, little time is spent on the unique processes in searching for and creating knowledge. Therefore, the management research literature can give a false impression of the research process. Our purpose is to mitigate the likelihood that such a false impression becomes the received wisdom by documenting the process and product of Penrose's (1959) resource-based approach.

This paper does not deal with scientific method and epistemology that explore which hypotheses are true. Rather, this paper, following Ladd (1987) and Weick (1989), considers temporally and logically prior issues that are of concern to all management researchers. What are the sources of hypotheses? How can we generate useful hypotheses in the knowledge-creation process? We apply these research process issues to the case of Edith Tilton Penrose's (1959) *The Theory of the Growth*

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of the Firm and consider the following questions. How did Penrose develop her 'resources approach' (1959, p. 217)? What were the sources of Penrose's hypotheses? What were Penrose's major contributions to the management literature? What have been the subsequent contributions and why was Penrose's book so generative of further inquiry in management science? We focus on the process of discovery for Penrose (1959) – a classic that has been translated into Japanese, French, Spanish and Italian (Penrose, 1971, p. viii). Such an undertaking is timely because this classic has made an enormous impact on strategic management, especially in the context of resource-based theory in the 1980s and 1990s (Collis and Montgomery, 1997; Wernerfelt, 1984).^[1]

Edith Tilton Penrose (1914–96), an American-born British economist and management theorist, received her PhD at John Hopkins University in 1950. Penrose held positions at John Hopkins University, the Australian National University, Bagdad University, the University of London and INSEAD. Her variety of experiences informed her broad research agenda. She published more than one hundred articles and essays that covered an extraordinary range of topics including: (1) international patenting (Penrose, 1951, 1973); (2) the theory of the firm (Penrose, 1952); (3) limits on the rate of firm growth (Penrose, 1955, 1960); (4) multinational enterprise (Penrose, 1956); (5) the growth of the firm (Penrose, 1959, 1995); (6) economic history (Penrose, 1965); (7) the international oil industry (Penrose, 1968); (8) economic development of the Middle East (Penrose, 1971); and (9) developments in Iraq (Penrose, 1978).

Penrose notes that her research areas (including the growth of the firm, the growth in the international petroleum industry and growth in the Middle East generally) are 'connected by the same type of historical logic that characterizes the diversification of an industrial firm: the logic in the simple principle that one thing leads to another' (1971, p. viii). Penrose's research emphasizes history, purposive behaviour, evolutionary processes, dynamics, disequilibrium, struggle and learning. Looking back on her work, Penrose states: 'One of the primary assumptions of the theory of the firm is that "history matters"; growth is essentially an evolutionary process and based on cumulative growth of collective knowledge in the context of a purposive firm' (1995, p. xiii). Firms differ in the resources they hold and in current strategies they carry out due to the differences in strategic choices made and the competitive positions envisioned by their leaders in the past.

The first section of the paper investigates the research process that leads to Penrose's (1959) precise and logical classic.^[2] We argue that Penrose's research process can be emulated to generate fruitful management theory. In fact, Penrose's research *process* and her research *product* are inextricably intertwined.

While it has been argued elsewhere that Penrose (1959) contributes to a rich understanding of a resource-based theory of the firm (Mahoney and Pandian, 1992; Wernerfelt, 1984), the second section of the current paper focuses on the product or content of Penrose (1959) and highlights the book's contributions to management theory, as we have passed the fortieth anniversary of its publication. This section analyses Penrose's book in a more comprehensive and systematic way than is currently available in the management literature. Such an analysis is necessary for demonstrating the substantive product generated from Penrose's research process.

Our argument goes further, suggesting that Penrose's research approach provides a model that can lead to more long-lasting generative research. This argu-

ment needs to be defended both by documenting how Penrose's (1959) research product has contributed to modern resource-based theory and by demonstrating how Penrose's research process can facilitate contemporary and future theory building. Thus, the third section documents the generative nature of Penrose's book in both contemporary economics and strategic management and the fourth section discusses the potential for new research building on Penrose's 'resources approach'.

PENROSE'S THEORY CONSTRUCTION AS DISCIPLINED IMAGINATION

Pasteur's comment that 'chance favours only the prepared mind' is applicable to the case of Penrose's research creativity. By the time *The Theory of the Growth of the Firm* was published in 1959, Penrose had been informed by an interactive learning process that included: (1) interviews with managers pragmatically rooted in real-world problems; (2) conversations with students and colleagues; (3) research on economic theories of growth; (4) studies of business history; (5) research on business literature and annual reports; and (6) extended company visits and observations. We cover each of these elements of Penrose's research process in turn.

In terms of interviews with senior managers, the Oxford Economic Research Group, in the 1950s, initiated a series of conversations between business faculty and senior managers in high-growth firms. Sixteen business executives came to Oxford over a period of less than three years and Penrose was aware of these interactions. Richardson and Leyland note: 'The informal and highly confidential character of our conversations gave our visitors fewer grounds for reticence than would otherwise have been the case. Some subjects, such as the nature of managerial limitations to growth, lend themselves more readily to investigation by discussion than they do to other more elaborate techniques' (1964, p. 1). Furthermore, Richardson notes: 'A very striking number of our [top management] guests expressed the view without hesitation that the availability of suitable management had been, and was, the operative check on their expansion . . . [A]s Mrs. Penrose has effectively brought to our attention, management functions as a team, with links of familiarity and confidence between its members' (1964, pp. 10–11). Lessons learned from these discussions are reported in Richardson (1964).

In terms of conversations with colleagues, economists such as Fritz Machlup and G. H. Evans at John Hopkins University were influential in developing Penrose's deductive skills in the process of completing her dissertation on international patents in 1950, and they were an important audience for Penrose in the process of working on her theories of the growth of the firm (Machlup, 1967; Penrose, 1985). Moreover, in terms of economic theories of growth, Roy Harrod's (1952) and Evsey Domar's (1957) growth models were informative. However, Penrose does note: 'I scoured the literature of the theory of the firm in theoretical economics for discussions of the subject [of the growth of firms] with increasing frustration' (1985, p. 6).

As for the business history and business literature, Penrose, in various works, cites the following as influential to her thinking: (1) Babbage's (1832) book on the economy of machinery and firm growth; (2) Robinson's (1932) book on firm

growth and the structure of competitive industry; (3) Florence's (1933, 1953) works on growth in British and American industry; (4) Gordon's (1945) book on the growth of the large corporation; (5) Heller's (1951) *Harvard Business Review* article on firm growth; (6) Williamson's (1952) book on Winchester Repeating Arms and its extensive diversification programme that failed because the programme was too extensive and too diverse for the company's existing experiences; (7) Christensen's (1953) book on small, growing enterprises; (8) Passer's (1953) study of vertical integration and diversification in the early electrical companies; (9) Schroeder's (1953) account of the growth rates of major steel companies in the 1900–50 period; (10) Weston's (1953) book on the growth of large firms; (11) Kaplan's (1954) book on firm growth and public policy; (12) McLean and Haigh's (1954) *Harvard Business Review* article on how business corporations grow; (13) Wilson's (1954) historical account of Unilever; (14) Maurer's (1955) book on the growth and behaviour of large corporations; and (15) Newcomer's (1955) work on management in big business. Clearly, Penrose's (1959) theoretical development was informed by her research process that included her wide readings of business history and business literature. For example, Penrose notes: 'Charles H. Wilson's *History of Unilever* is a model of what good firm histories can be. I have leaned heavily on this type of work (and there are some others), as well as on direct discussions with businessmen, for insight into the processes of firm growth' (1959, p. 3).

Of the items listed above, we believe that, in addition to Wilson (1954), the 1951 *Harvard Business Review* article by Walter Heller of the University of Minnesota had an especially important impact on Penrose's thinking that led to *The Theory of the Growth of the Firm*. Heller (1951) reports the results of a field study on investment decisions by business people in the Twin Cities in Minnesota in 1950. Heller (1951, p. 102) found:

One of the unforeseen – and most interesting – investment barriers encountered was the bottleneck in top engineering and management talent. In more than half of the companies studied, it was flatly stated that either (1) the post war pace of capital expansion had been too fast for top management and engineering staffs to handle efficiently and digest thoroughly, and a pause for digestion was now in order, or (2) the rate of capital expenditure had been, and still was being, held down to what the very scarce factor of 'brains' – engineering and managerial – could handle.

In terms of corporate visits and observations, Penrose (1956) documents the expansion at General Motors–Holden Ltd in Australia, and she documents her observations gathered from her six weeks of studying from within the Hercules Powder Company in the summer of 1954 (1960, awarded the Newcomer Prize for the best article to appear in *Business History Review* during the year 1960). This article, analysing the growth of the Hercules Powder Company, was originally intended for inclusion in *The Theory of the Growth of the Firm* but was omitted in order to limit the size of the book (Penrose, 1960, p. 1). Lessons learned from this six-week study include:

- (1) There is a close relationship between the various kinds of resources within which a firm works and the development of the ideas, experience and knowledge of its managers and enterprise (1960, p. 2);

- (2) Expectations are to be explained with reference to the firm's resources (1960, p. 3);
- (3) Skills and resources are based on complementary assets (1960, p. 5);
- (4) Specialization can lead to diversification. For example, Hercules' base in cellulose chemistry enabled it to take advantage of the growing markets in the artificial fibre and plastics industries (1960, p. 7);
- (5) The scarcity of managerial talent acts as a limit to firm growth (according to some executives at the company) (1960, p. 21); and
- (6) The entrepreneurship of a firm will largely determine how imaginatively and how rapidly it exploits its potentialities (1960, p. 23).

Clearly many of the deductive arguments provided in Penrose (1959) were greatly informed by her inductive case study of the Hercules Powder Company.

Penrose's (1959) classic book, achieved by combining multiple learning skills, theoretical pluralism and methodological triangulation (Mahoney, 1993), illustrates the claim that research creativity can often be generated from experience and disciplined imagination (Eisenhardt, 1989; Weick, 1989). Penrose's imaginative capabilities enabled her to produce a cohesive synthesis, derived through an iterative process of induction and deduction, and informed by multiple levels of inquiry. Penrose's book was essentially the product of disciplined imagination that linked things that were not formerly seen to be connected (i.e. the dynamic interaction of managers, resources and services of resources).^[3] While Penrose's (1959) book provides a deductive reconstructed logic (Kaplan, 1964) of firm growth as a bundle of resources tied together administratively, we argue that her research process was both deductive and inductive. Penrose's research process was less a linear process, and more like a circular process combining deductive logic and inductive reasoning. It was inductive to the extent that Penrose was informed by interviews with managers, studies of business histories, research on annual reports and her extended company visits and observations. Penrose started from an observed regulatory of limits to the rate of growth of the firm and constructed an explanation. Penrose's creative process is described as inductive since it involved finding a set of assumptions one of whose consequences is the limits to the rate of firm growth.

Now that we have documented Penrose's research process, the next section provides a summary of the research product in her classic book, *The Theory of the Growth of the Firm*. This second section focuses on the content of Penrose (1959) and highlights its contributions to management theory and demonstrates the substantive product generated from Penrose's research process.

THE PRODUCT OF PENROSE'S RESEARCH CREATIVITY: THE THEORY OF THE GROWTH OF THE FIRM

In his review of the *The Theory of the Growth of the Firm*, Marris (1961) suggested that Penrose's book (1959) was likely to be one of the most influential of the decade. As things turned out, Penrose (1959) proved to be one of the most influential books of the second half of the twentieth century bridging economics and management. This section considers the book's major contributions to the economics and management literatures. We analyse both Penrose's (1959) arguments

and their connections to modern resource-based theory in a more comprehensive and systematic way than is currently available in the economics and management literatures.

This section describes what we believe to be the fundamental arguments of Penrose's *The Theory of the Growth of the Firm* in the order in which they first appeared in the book.

Idea 1: Firm growth can be usefully studied as a dynamic process of management interacting with resources.

Penrose emphasizes a dynamic, interactive process of growth and the limits to the rate of the growth of the firm.^[4] Penrose argues: 'the experience of management will affect the productive services that all of its other resources are capable of rendering. As management tries to make the best use of resources available, a truly "dynamic" interacting process occurs which encourages continuous growth but limits the rate of growth' (1959, p. 5). The services of resources^[5] are upstream from the end product – they reside in a generalizable capability that might find a variety of final product applications. The catalyst for this resource conversion process is the resource of management (Mahoney, 1995). The firm's managers recombine the firm's resources. Managing resources and capabilities are the keys to competitive advantage. The multi-use potential services of resources can be discovered through 'human-machine interaction' (Balakrishnan, 1988, p. 188). Physical and human resources can complement and reinforce one another for sustaining competitive advantage. Sustainable competitive advantage is conferred by the complementarity of these resources because they can be hard to imitate, and scarce relative to their economic value.

Idea 2: Firms are institutions created by people to serve the purposes of people.

Penrose's book on the theory of the growth of the firm was motivated by her early dissatisfaction with stochastic theories of firm growth. Penrose (1959) emphasizes that firms are institutions created by people to serve the purposes of people. Penrose stresses the importance of human volition – of human decisions and motives. Managers are motivated by the struggle for survival and by the need for achievement and recognition to generate both creative innovations and adaptive responses via new resource combinations.^[6] Penrose argues: '... a firm is more than an administrative unit; it is also a collection of productive resources the disposal of which between different uses and over time is determined by administrative decision' (1959, p. 24). Penrose (1959) was clearly informed by theories of administrative co-ordination and authoritative communication as developed by Barnard (1938), Cyert and March (1955) and Simon (1947).

Idea 3: Services of resources are drivers of firm heterogeneity.

Penrose (1959) argues that the potential services of resources provide the uniqueness for each firm. Penrose states: 'Strictly speaking, it is never *resources* themselves that are the "inputs" in the production process, but only the *services* that the resources can render' (1959, pp. 24–5). Penrose (1959, p. 25) emphasizes the uniqueness of each individual firm due to the dynamic interactions among managers, resources and services of resources. Penrose states: "The productive activities of such a firm are governed by what we shall call its "productive opportunity", which comprises all of the productive possibilities that its "entrepreneurs" see and

can take advantage of.^[7] A theory of the growth of firms is essentially an examination of the changing productive opportunity of firms' (1959, pp. 31–2). The manager's 'image' (Boulding, 1956) is influenced by the resources that the firm possesses. This image gives rise to the 'subjective' productive opportunity of the firm (Penrose, 1959, p. 42) and is a further driver of firm heterogeneity and differential 'absorptive capacity' (Cohen and Levinthal, 1990) among firms. Penrose states: 'The imaginative effort, the sense of timing, the instinctive recognition of what will catch on or how to make it catch on become of overwhelming importance. These services are not likely to be equally available to all firms' (1959, p. 37). Entrepreneurial imagination (i.e. an expectation concerning productive opportunities) is influenced by past experiences of interactions between managers and resources. Thus, the firm is both pushed by the past and pulled by the future (Boulding, 1956).

Idea 4: Services that material resources will yield depend upon the knowledge possessed by human resources. The two together create a subjective productive opportunity that is unique for each firm.

An important component of Penrose's (1959) theory of the growth of the firm concerns the interaction between material and human resources. Penrose states: 'The possibilities of using services change with changes in knowledge . . . Consequently, there is a close connection between the type of knowledge possessed by the personnel of the firm and the services obtainable from its material resources . . . [U]nknown and unused productive services become of considerable importance not only because the belief that they exist acts as an incentive to acquire new knowledge, but also because they shape the scope and direction of the search of knowledge' (1959, p. 77). Thus, firm development is an evolutionary and cumulative discovery procedure of 'resource learning' (Mahoney, 1995) where resources and capabilities may serve as 'cognitive drivers' for strategy (Itami and Numagami, 1992). The firm has a specialized knowledge-creation process and capabilities for managing its resources. Furthermore, resources are developed to match the special talents of the organization. Marris (1964, p. 16) argues that this matching of material and human resources is a unique result of the historical process. What results is the firm as a 'going concern'.

When the knowledge of the firm increases either intentionally or due to 'external conditions' (Penrose, 1959, pp. 215–17), so do the amount and variety of services potentially available from any single resource. Managerial services – which is a well-validated set of constructs for selecting and interpreting data and for making effective and timely decisions (Loasby, 1983) – continuously expand due to learning by doing and due to acquisition and use of new knowledge during the process of new product introductions.

Thus, because the historical process matters, a firm will diversify in non-random directions. Penrose states: 'if resources were completely non-specific, a firm could in principle produce anything . . . The selection of the relevant product-markets is necessarily determined by the "inherited" resources of the firm – the productive services it already has' (1959, p. 82). Penrose further states: 'There is a close relation between the various kinds of resources with which a firm works and the development of ideas, experience, and knowledge of its managers and entrepreneurs, and we have seen how changing experience and knowledge affect not only the productive services available from resources, but also "demand" as

seen by the firm' (1959, p. 85). The accumulation of resources and services creates a base for organizational learning. Furthermore, organizational learning and new organizational forms allow firms to increase their rate of resource accumulation.

Idea 5: Firm growth is a function of firm-specific experiences in teams.

Penrose (1959) stresses the importance of teamwork and organizational capital for understanding the process of co-ordinating the organization's activities as a coherent bundle of resources that are complementary and reinforcing for achieving human purposes. Successful firm growth requires co-operation and co-ordination in management teams. Such co-operation is enhanced by firm-specific team experiences over time. Penrose notes: 'The nature of the organization of a firm and the relationships between the individuals within it have often as important an influence on the competence and enterprise of management and on the kinds of decisions taken as do the inherent characteristics of the individuals themselves' (1959, p. 32). Penrose emphasizes the subjective productive opportunity of the firm based on firm-specific capital, teamwork and associational experience (e.g. confidence in the integrity and ability of co-workers gained via informal organization and the transfer of tacit knowledge). Penrose (1959) also notes that associational experience may provide important benefits at the top of an organization since decisions can involve high risk under conditions of environmental uncertainty and irreversible commitment. Furthermore, Penrose states: 'Existing managerial personnel provide services that cannot be provided by personnel newly hired from outside the firm, not only because they make up the administrative organization which cannot be expanded except by their own actions, but also because the experience they gain from working within the firm and with each other enables them to provide services that are uniquely valuable for the operations of the particular group with which they are associated . . . Extensive planning requires the cooperation of many individuals and this *requires knowledge of each other*' (1959, pp. 46–7). Thus, Penrose emphasizes experience-based knowledge and endogenous growth (Knudsen, 1996; Nahapiet and Ghoshal, 1998).

Best (1990, p. 28) refers to Penrose's (1959) theory as a learning theory of the firm. The value of new managers to the organization increases as they become more familiar with the communication system and the peculiarities of their own special tasks (Malmgren, 1961). Penrose concludes: 'It is the heterogeneity, and not the homogeneity of the productive services available from its resources that gives each firm its unique character' (1959, p. 75). Management teams that evolve over time are among the most valuable resources of the firm, since they yield entrepreneurial services in the form of intelligent and purposeful expansion and diversification, driven by team-level capabilities and collective trust among the members of the team.

Idea 6: Managerial capability is the binding constraint that limits the growth rate of the firm – the so-called 'Penrose effect'.

Drawing from the business literature, business histories and her own company visits and observations, Penrose (1959) contributes to the theory of the firm by suggesting that a scarcity of firm-specific managerial talent was the main limit on the rate of the growth of the firm. Penrose argues: 'if a firm deliberately or inadvertently

expands its organization more rapidly than the individuals in the expanding organization can obtain the experience with each other and with the firm that is necessary for the effective operation of the group, the efficiency of the firm will suffer . . . and a period of "stagnation" may follow . . . Since the services from "inherited" managerial resources control the amount of new managerial resources that can be *absorbed*, they create a fundamental and inescapable limit to the amount of expansion a firm can undertake at any time' (1959, pp. 47–8). In addition to the assimilation of new personnel into an organization, it is important to consider the firm's absorptive capacity of new knowledge and technology. Anticipating the work of Cohen and Levinthal (1990) on absorptive capacity, Penrose suggests that limits on the 'absorption of modern technology' (1965, p. 8) can be the binding constraint on growth.

Idea 7: Excess capacity of productive services of resources are drivers of firm growth.

Penrose emphasizes indivisibilities in machines, managers, R&D and engineering. Excess capacity of resources and market frictions are sources for expansion to achieve full utilization of resources. Penrose refers to these phenomena as the 'balance of processes' (1959, p. 68) and she cites earlier discussions by Babbage (1832, chapter 21) on 'direct multiples',^[8] by Robinson (1932, pp. 31–3) on 'balance of processes', and by Florence (1933, pp. 18–20) on 'principle of multiples'. For example, some excess human resources are made available in the process of learning how to do current operations more efficiently and this frees up firm-specific managerial resources for further expansion.

Where there are efficient markets, diversification can be of questionable value. However, as the resource-based approach emphasizes, a distinctive feature of excess capacity in firm-specific human capital is that there is not an efficient market for this inherently immobile collective knowledge produced internally. Penrose notes: 'The jig-saw puzzle becomes more complicated when we consider imperfections of the market . . . and the problem of "balancing processes" may carry the firm off in entirely new directions' (1959, p. 70). Penrose goes on to note that there is a "virtuous circle" in which "specialization leads to higher common multiples to greater specialization" (1959, p. 73).

The virtuous circle of growth evolves from initial conditions of specialization and firm-specific indivisibilities that lead to firm growth. Expansion of scale due to growth, in turn, enables further specialization. Specialization enhances learning by doing over time and yields underutilized productive services (i.e. excess capacity). The firm opts for expansion of the existing businesses and/or diversification into new businesses to achieve economies of scale and scope, given corporate entrepreneurs' visions and interactions.

When the firm diversifies, human resources continue to learn due to exposure to new knowledge and challenges in the new businesses. This new knowledge helps in the creation of strategic options for growth that can lead to still further increases in absorptive capacity (Foss, 1998). Both growth and diversification feed into each other since they share the common pool of services that expands as human resources continue to learn. An optimal growth of the firm involves utilization of existing resources (via economies of scale and scope) and development of new resources and capabilities (Penrose, 1959; Rubin, 1973; Wernerfelt, 1984). Scale and scope economies lead to intertwined dynamic corporate capabilities

(Chandler, 1990; Penrose, 1959). Penrose (1959) provides a foundation for evaluating dynamic corporate coherence and competence-based competition (Christensen and Foss, 1997).

Idea 8: Unused productive services of resources can be a source of innovation.

In some ways, Penrose's theory of the growth of the firm is influenced by Schumpeter's (1934) writings on entrepreneurship and innovation. Penrose argues: 'Unused productive services are, for the enterprising firm, at the same time a challenge to innovate, an incentive to expand, and a source of competitive advantage. They facilitate the introduction of *new combinations of resources* – innovation – within the firm' (1959, p. 85). Penrose emphasizes not only product innovation but also organizational innovation as a stimulus for firm growth. Entrepreneurial imagination is required to see potential synergies and to see new applications. Penrose describes entrepreneurial imagination as a discovery process, searching for 'interstices' (1959, p. 223) as opportunities for growth.

Idea 9: Firm diversification is often based on a firm's competencies that can lead to a sustainable competitive advantage.

Penrose argues: 'Diversification and expansion based primarily on a high degree of competence and technical knowledge in specialized areas of manufacture are characteristic of many of the largest firms in the economy. This type of competence together with the market position it ensures is the strongest and most enduring position a firm can develop' (1959, p. 119). Here, Penrose emphasizes the complementarity between product-market positioning and resource-based competition. Competencies depend on the tacit understanding, capabilities and resources that a firm accumulates over time. Companies grow in the directions set by their capabilities and these dynamic firm capabilities slowly expand and change. Richardson notes: '[W]e cannot hope to construct an adequate theory of industrial organization and in particular to answer our question about the division of labour between firm and market unless the elements of organization, knowledge, experience and skills are brought back to the foreground of our vision . . . Mrs. Penrose has provided us with excellent accounts of how companies grow in directions set by their capabilities and how these capabilities themselves slowly expand and alter' (1990, p. 231). A rich connection among the firm's resources, competencies and the productive opportunities perceived by the managerial team drives the diversification process.

Furthermore, a firm may achieve rents – where rents are defined as returns in excess of a resource owner's opportunity costs – not only because it has better resources, but also because the firm's competencies involve knowing its resources and making better use of its resources (Penrose, 1959, p. 54). Prescott and Visscher (1980) refer to the ability to allocate (human) resources more efficiently as organizational capital.^[9] Such firm-specific knowledge and experience suggest that the firm is a repository of productive knowledge (Nonaka and Takeuchi, 1995, p. 34). Foss, following Loasby (1991), Fransman (1994) and Spender (1994), takes this idea forward submitting that the essential Penrosian point is the following: 'Penrose emphasized that not only is the firm a repository of productive knowledge, but it is also an institution that develops and manages this knowledge and that the two processes of developing and managing knowledge may be hard to separate, both in practice and conceptually' (1998,

p. 3). Rents are thus generated and sustained through both the development and management of firm-specific resources.

Idea 10: An important component of the competitive process is experimentation.

Penrose argues that experimentation is essential for changing the firm's productive opportunity. Penrose notes: 'The continual change in the productive services and knowledge within a firm along with the continual change in external circumstances present the firm with a continually changing productive opportunity' (1959, p. 150). A firm is not only an accumulation of knowledge, but is engaged in a continuous search and selection process to upgrade its technological and organizational knowledge, and thereby improves its likelihood of superior performance (Makadok and Walker, 1996; Nelson and Winter, 1982). Penrose (1959) emphasizes product innovation *and* organizational innovation in the process of expanding its productive opportunity. Penrose states: 'Management's experiments with different types of corporation structures *are in themselves an important aspect of competition*' (1959, p. 263). Once again, Penrose's (1959) book has striking parallels with Chandler's (1962) *Strategy and Structure*. Both classics note that the strategy of diversification requires organizational innovation as both an adaptive and creative response. Otherwise, inefficiency may result. Figure 1 summarizes the ten arguments found in Penrose's (1959) text.

Now that we have documented Penrose's research process and research product in the first two sections, in the next section we move forward to demonstrate that Penrose's research approach leads to more long-lasting generative research. This argument needs to be defended both by documenting the influence of Penrose's (1959) research product on current resource-based theory and by demonstrating how Penrose's research process can facilitate contemporary and future theory building (Frost and Stablein, 1992). Thus, the third section documents the generative nature of Penrose's book in resource-based theory, and the fourth section discusses the potential for new research that builds on Penrose's 'resources approach'.

THE INFLUENCE OF PENROSE'S 'RESOURCES APPROACH' ON MODERN RESOURCE-BASED THEORY

The continued influence of Penrose's 'resources approach' (1959, p. 217) as a distinct conceptual framework for the purpose of understanding firm-level growth is evident in recent strategic management textbooks (e.g. Barney, 1997; Collis and Montgomery, 1997; Grant, 1995) that situate the resource-based theory as the crown jewel of strategic management. Following these textbooks, we define broadly the modern resource-based theory to include: (1) the resource-based view (Wernerfelt, 1984); (2) commitment (Ghemawat, 1991); (3) dynamic capabilities (Nelson, 1991; Porter, 1991; Teece et al., 1997); and (4) the knowledge-based view (Kogut and Zander, 1992, 1996; Spender, 1996). These four areas naturally blend into each other (Bogner et al., 1998; Williamson, 1991).

In this section we document Penrose's influence on the resource-based approach^[10] by using the classification system of Itami and Numagami (1992). Itami and Numagami argue: 'Solid research methodology is necessary when one wants to persuade others that one's statements are valid or correct' (1992, p. 132). According to Itami and Numagami (1992), persuasion in social science is based on four important components that we consider in turn: (1) mathematical models

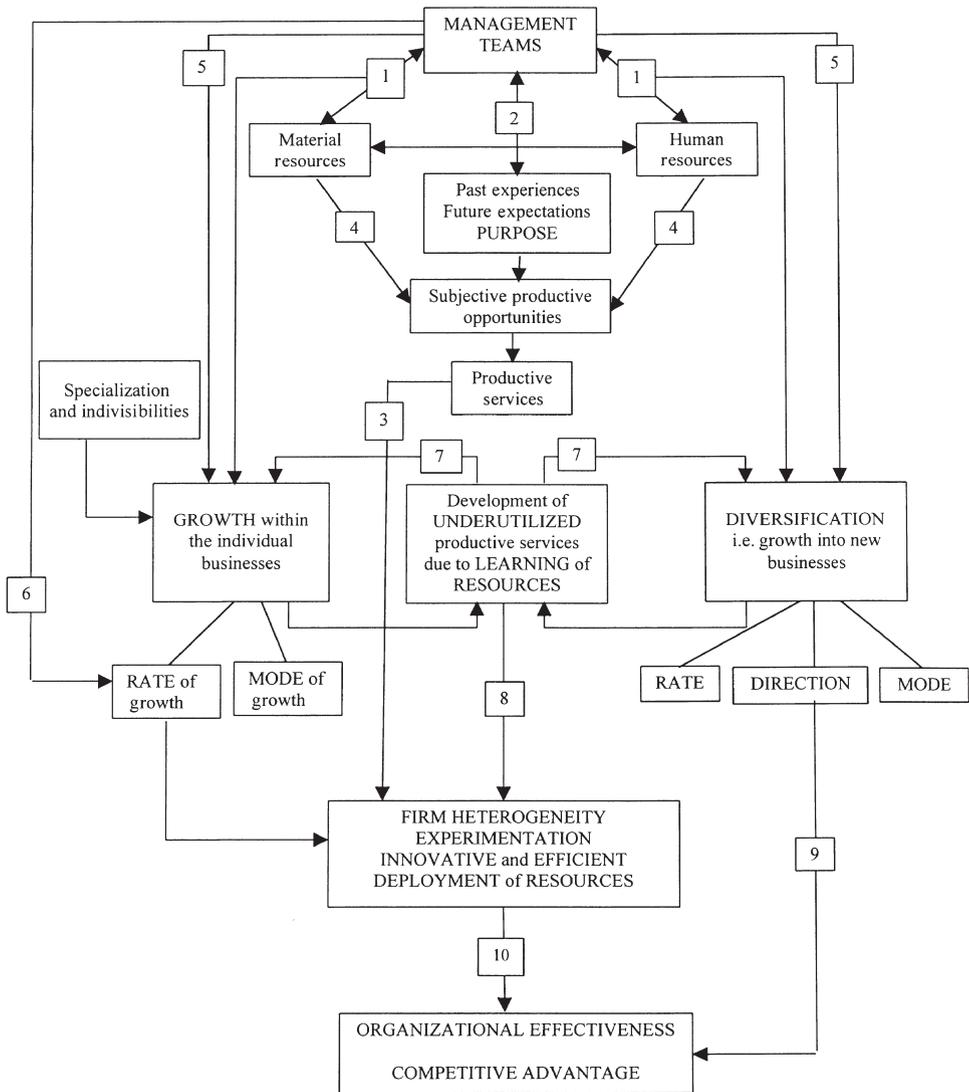


Figure 1. Penrose's model of the resource growth process

Note: The ten interrelationships highlighted in this model are further developed in the paper and these ten interrelationships are also summarized in table 1.

in which well-defined assumptions and correct operations ensure an audit trail for subsequent conclusions; (2) statistical data analysis which relies on the theory of probability in drawing inferences from the statistics; (3) logical compound synthesis that provides robust coherence among component stories; and (4) in-depth case studies in which history is the most familiar. In-depth case studies are forms of data gathering and are often qualitative.

Mathematical models. Although Penrose (1959) did not provide a mathematical model in her book, Penrose's arguments inspired several subsequent models in the industrial organization literature including: (1) Baumol (1962); (2) Marris (1963,

1964); (3) Williamson (1966); (4) Uzawa (1969); (5) Rubin (1973); (6) Prescott and Visscher (1980); (7) Slater (1980b); (8) Oi (1983); (9) Hay and Morris (1991); and (10) Ingham (1992). In addition to these models drawing from Penrose's ideas, there are also a number of mathematical models resembling Slater (1980b) and Ingham (1992) that have looked at the more general case of 'non-separable adjustment costs' (Mortensen, 1973; Treadway, 1970). The installation of new plant and equipment requires the diversion of other factors of production from their current tasks, disrupting current production. Therefore, the adjustment costs include the value of the lost current production that is consequently not independent of current output rates.

Penrose (1959), of course, focused on the specific case of the adjustment costs involved in having current managers train new managers as they entered the organization. The managerial services that a firm requires at a point in time are partly constrained by the necessity to run the firm at its current level of operations, and are partly required to carry out expansionary ventures. The training of new managers and their integration into the workforce occupy some of the time and attention of existing managers, and thus reduce the managerial services available for expansion. The rate of the growth of the firm is both determined and constrained by the quality of management and its capacity to plan for the future (Auerbach, 1988, p. 138). In Penrose's theory 'management (is) both the accelerator and the brake for the growth process' (Starbuck, 1965, p. 490). Thus, there is a managerial constraint on the growth rate of the firm, the so-called 'Penrose effect' or 'Penrose theorem' (Marris, 1964, p. 114), which suggests that fast-growing firms in one period tend to experience slower growth in the next period.

Finally, we note that Penrose's (1959) subjective resources approach is consistent with contemporary strategic management that models uncertain imitability and heterogeneity under competition (Lippman and Rumelt, 1982; Lippman et al., 1991). Isolating mechanisms (barriers to imitation) explain (*ex post*) a stable stream of rents and provide a rationale for intra-industry differences in performance among firms. Irreducible uncertain imitability due to causal ambiguity generates the heterogeneity of firms and also acts as an isolating mechanism for divergence (i.e. sustaining heterogeneity) through processes of variation and selection. Equilibrium is permeated by heterogeneous firms with evolved local advantages. It is the juxtaposition of isolating mechanisms with uncertainty that permits the modeling of heterogeneity and rents (Rumelt, 1984).

Statistical data analysis. Although claims of the lack of empirical studies of the resource-based theory of the firm would have been accurate in the mid-1980s, such claims made at this point are uninformed. Penrose's theoretical arguments (and subsequent developments in strategic management) have been subject to empirical testing. Taking the so-called realist position, Godfrey and Hill argue that ultimately the resource-based approach will 'stand or fall not on the basis of whether its key constructs can be verified, but upon whether its predictions correspond to reality observed by populations of firms' (1995, p. 530). We concur that unobservables can be useful for making predictions in the resource-based approach. We add that while predictions are the touchstone of science, managers' and researchers' understanding is enriched by improved abilities to explain as well.

Empirical studies have tested the following resource-based topics: (1) the 'Penrose Effect' (Gander, 1991; Shen 1970; Thompson, 1994); (2) the importance

of unique resources and 'focus' on firm performance (Harrison et al., 1993; Markides, 1992, 1995; Montgomery and Wernerfelt, 1988; Mosakowski, 1993; Sharma and Kesner, 1996; Wernerfelt and Montgomery, 1988); (3) the importance of organizational factors such as human resource management and human capital (Chang, 1996; Farjoun, 1994; Hansen and Wernerfelt, 1989); (4) the importance of competencies, complementarities, coherence and combinative capabilities in the resource accumulation and deployment process (Capron et al., 1998; Helfat, 1994, 1997; Henderson, 1994; Henderson and Cockburn, 1994; Iansiti and Clark, 1994; McGrath et al., 1995; Majumdar, 1998; Robins and Wiersema, 1995; Teece et al., 1994; Zander and Kogut, 1995); (5) the importance of property rights and regulation in the resource accumulation process (Majoor and Witteloostuijn, 1996; Miller and Shamsie, 1996; Russo and Fouts, 1997); (6) the importance of effective alliances in the resource accumulation process (Chang, 1995; Eisenhardt and Schoonhoven, 1996; Kay, 1997; Mowery et al., 1996; Singh and Mitchell, 1996); (7) related diversification, based on indivisibilities and knowledge-based resources (Chatterjee, 1990; Chatterjee and Wernerfelt, 1991; Farjoun, 1998; Lemelin, 1982; MacDonald, 1985; Merino and Rodriguez, 1997; Montgomery and Hariharan, 1991; Singh and Montgomery, 1987); (8) the importance of international expansion in the resource accumulation process (Barkema and Vermeulen, 1998; Chang, 1996; Penner-Hahn, 1998); and (9) 'firm effects' on performance (Anand and Singh, 1997; Brush and Bromiley, 1997; Mauri and Michaels, 1998; McGahan and Porter, 1997; Powell, 1996; Rumelt, 1987, 1991). Clearly, resource-based theory has begun to generate a substantive stream of statistical data analysis.

Logical compound synthesis.^[11] Arguably, the most headway in the resources approach has taken place with theoretical development within strategic management (e.g. Barney, 1991; Conner, 1991; Mahoney and Pandian, 1992; Peteraf, 1993). Recent surveys (e.g. Bogner et al., 1998; Oliver, 1997) can be found elsewhere and will not be repeated in this section. Here we simply point out that competent development of the resource-based theory of the firm requires knowledge of organization theory (e.g. Kazanjian and Drazin, 1987) and organizational economics (e.g. Barney and Ouchi, 1986; Mahoney, 1992) including: (1) Penrose's disequilibrium resources approach (Teece, 1982); (2) an equilibrium approach (Barney, 1991; Lippman and Rumelt, 1982); (3) property rights (Hart, 1995; Liebeskind, 1996; Rumelt, 1984); (4) game theory and sunk costs (Ghemawat, 1991); (5) behavioural theory of the firm (Amit and Schoemaker, 1993); (6) networks (Eisenhardt and Schoonhoven, 1996); (7) agency theory (Collis and Montgomery, 1997); (8) transaction costs theory (Chi, 1994; Madhok, 1997); (9) Schumpeterian (evolutionary) theory (Loasby, 1991; Teece and Pisano, 1994); and (10) the firm as a knowledge system (Conner and Prahalad, 1996; Foss, 1996b; Grant, 1996; Madhok, 1996; Pennings et al., 1998; Szulanski, 1996; Tsoukas, 1996). Indeed, Penrose's analysis of the subjective opportunity of the firm informs the knowledge-based view of the firm (Spender, 1996).

Our argument is that further development of resource-based theory will be facilitated by a rich understanding of Penrose's (1959) disequilibrium approach in combination with these other approaches identified above. Such combinations can drive further inquiry in resource-based theory. For example, the resource-based theory is linked to property rights since delineated property rights make resources

more valuable and as resources become more valuable, property rights become more precise (Mahoney, 1992). The resource-based theory is linked to the behavioural theory of the firm, if superior heuristics lead to economic rents (Amit and Schoemaker, 1993). The resource-based theory is linked to agency theory because the resource deployment of the firm is influenced by agency costs (Castanias and Helfat, 1991).

Finally, the relationship between the theory of the existence of the firm in transaction costs theory and the 'strategic (rent-sustaining) firm' (Rumelt, 1984, p. 561) in resource-based theory is the following. In transaction costs theory, for the existence of the firm there must be some type of market friction (e.g. economies of scale and sunk costs violate the price-taking assumption of perfectly competitive markets; positive transaction costs result in less than complete markets; externalities violate the assumptions of zero interdependence in consumption and production; and asymmetric information violates the assumption of perfect information). In resource-based theory, for the firm to sustain rents there also must be some type of market friction. In fact, the set of market frictions sufficient to explain why the firm can sustain rents will be sufficient to explain why the firm exists. Or put differently, the subset of market frictions that not only explains the existence of the firm but also the strategic (rent-sustaining) firm is isolating mechanisms (Mahoney and Pandian, 1992; Rumelt, 1984).

While resource-based theory and transaction costs theory are tightly linked in terms of explaining the sustainability of rents, we emphasize that resource-based theory is distinctive. In addition to sustaining rents, resource-based theory, following Penrose (1959), is concerned with explaining the sources of firm heterogeneity and the generation of rents. More fine-grained, in-depth case studies are especially valuable for achieving these objectives of resource-based theory (Foss, 1996a).

In-depth case studies. As documented above, Penrose (1959) is an exemplar of building theory from case-study research. Following in the case-study tradition (Eisenhardt, 1989), we suggest several exemplars of case study in resource-based theory. First, Chandler's (1990) historical study, *Scale and Scope*, documents the evolution of resource accumulation and the evolution of organizational capabilities of large enterprises in the United States, Great Britain and Germany. Typically, entrepreneurs had to make three sets of interrelated investments – investment in production, distribution and management. Second, Leonard-Barton's (1992) case studies of Ford, Chaparral Steel and Hewlett-Packard illustrate that the tight coupling of core capabilities can lead to core rigidities. Third, Hall (1993) investigates intangible resources and strategic factor market imperfections at six companies. Fourth, Ghemawat (1993) assesses the timing of sunk cost resource commitments at Nucor. Fifth, Ollinger (1994) examines the evolution of the US oil industry from a resource-based approach. Sixth, Argyres (1996) specifies the development of capabilities for cable connectors. Each of these in-depth case analyses provides rich connections among resources, services of resources, and managerial decision-making under uncertainty.

In summary, this section highlights the relevance of Penrose's (1959) 'resources approach' to modern resource-based theory and documents the fruitfulness of Penrose's research product for contemporary management research. Using Itami and Numagami's (1992) criteria for a successful research programme, this section

documents the substantial progress of the resource-based approach in terms of (1) mathematical modelling; (2) statistical data analysis; (3) logical compound synthesis; and (4) in-depth case studies. We conclude with the relevance of Penrose's research process for modern resource-based theory, and we suggest future research building on Penrose's 'resources approach'.

FUTURE RESEARCH BUILDING ON PENROSE'S 'RESOURCES APPROACH'

Lessons Learned from Penrose's Resources Approach

In this final section we reconsider questions asked at the beginning of this paper. What are the sources of hypotheses? How can we generate useful hypotheses in the knowledge-creation process? Of course, to some extent these questions deal with the haphazard, unpredictable complexity of research (Ladd, 1987). Still, in light of the knowledge gained from examining Penrose's research process, we believe that there are some helpful lessons to be drawn from Penrose (1959) concerning research process and theory building.

Diversity of knowledge, experiences and interests is a necessary condition for the initiation and development of innovative research (Ladd, 1987). Scientific invention is about creating a new 'bisociation' (Koestler, 1964), that is connecting things that were not formerly seen to be connected. Scientific creativity requires imagination and synthesis of parts, which may come from different disciplines, theories and phenomena. Diversity of knowledge also enhances the retention and retrieval of something learned, since pattern recognition and a network of conceptual associations enhance memory.

The first section of this paper documents the extraordinary range of topics that interested Penrose deeply. For the case at hand, Penrose combines knowledge of markets, industrial firms and the inner workings of these firms in producing her classic *The Theory of the Growth of the Firm*. While specialization and the division of labour are undeniably important in scholarly work, it can be beneficial to diversify one's knowledge pool as well. The moral of the story following Penrose's research process is that scholars need to be open to new ideas, perspectives and disciplines in their creative journey towards a 'magic synthesis' (Arieti, 1976).

Knowing different things is essential, yet not sufficient, since the creative and productive researcher also needs to know things in diverse ways. Using different methodologies and perspectives (i.e. triangulation) to understand the same phenomenon can also bring the research closer to synthesis in the process of discovery. Penrose not only gave close attention to the theories-in-use of managers but she also benefited greatly from a comprehensive study of the reconstructed logic of economic theory. Penrose was in search of a comprehensive and rigorous understanding of firm growth and the limitations of firm growth. If she had relied totally on deductive reasoning, she was unlikely to have come up with a *new* theory of the firm, since all the existing theories were based on the assumption of managerial diseconomies as the limit to firm size (Florence, 1953). By talking to managers, reading case studies and practice-oriented articles, and examining firms (e.g. Hercules Powder Company) from the inside, Penrose made the creative leap towards studying the *rate* of the growth of the firm.

On the other hand, if Penrose had only used inductive reasoning – if she had not specifically identified her assumptions, variables and interrelationships between

variables – she might have ended by just describing the phenomenon. Scientific creativity requires both synthetic and analytical skills. That is, creativity and scientific discipline have to come together for the scientific innovation to occur (Weick, 1989). A fertile imagination needs to be balanced by analytical rigour and critical judgement (Beveridge, 1957). Penrose's research process shows the power of combining well-developed inductive and deductive reasoning.

Van de Ven (1989, p. 486), following Lewin (1945), emphasizes: 'nothing is quite so practical as a good theory'. Here we argue that there is nothing so theoretical as a good practice. Much of Penrose's deductive theorizing arises from the theoretical foundations for good practices in the world of experience.^[12] While Penrose's (1959) book is written deductively, the logic of discovery came from managerial practice (see, for example, Heller, 1951). To put the matter in formal terms, Penrose (1959) is a classic, in part, because it connects the reconstructed logic (Kaplan, 1964) of deductive economics on the theory of the firm^[13] to the theory-in-use (Argyris and Schon, 1978) of managers, and thus contributes to management theory and practice.

Penrose's (1959) resources approach is still influential in modern management thought (Mahoney, 1995; Peng and Heath, 1996). Others have commented eloquently on why Penrose's (1959) book has long-lasting relevance (e.g. Foss, 1997b; Marris, 1961; O'Brien, 1997; Slater, 1980a). In particular, we find Slater's (1980a, p. vii) comments salient:

What is the secret of the book's success and reasons for its importance? I would say that it combines a rigorous economic theoretical outlook with immediate intelligibility and an obvious foundation in reality. It is a very clear description of what businessmen actually do, but it goes far beyond that . . . The book is primarily theoretical, not institutional, and it is an example of theory at its best – picking out the important principles, from a complicated real-world picture.

Huff (1981) makes the general case that multilectic inquiry facilitates the researcher's process of discovery. We argue here that Penrose's research process is an exemplar to illustrate Huff's (1981) thesis. Penrose's research process employing multiple levels of inquiry (e.g. economic theory, business histories, company visits) facilitated her research creativity.

We argue, following Penrose (1959), that this knowledge-creation process can be facilitated if strategic management researchers and managers become engaged in an interactive, reciprocating process. The objective is building pragmatic strategy theory where generalized (reconstructed) theories of researchers and contextual theories-in-use of managers may evolve via double-loop learning (Argyris and Schon, 1978). This dialectic of the double-loop learning approach to building strategy theory can help in reconnecting strategy theory with the realities faced by managers in dynamic environments (Mahoney and Sanchez, 1997). Bowman sums up the argument for greater theoretical interaction between management researchers and managers: 'The practitioner and the researcher are *doubly linked*: the researcher supplies insights, relationships, and theory for the practitioner. But the practitioner supplies puzzles, ideas, judgments, and priorities for the researcher' (1990, p. 27). We have argued in this paper that Penrose's research process is an exemplar of double-loop learning that connects the academic world

of 'inquiry from the outside' (via reconstructed models) with 'inquiry from the inside' (Evered and Louis, 1981) via managers' theories-in-use. Such rich connections are the stuff that classic management books and research creativity are made of.^[14]

Management researchers and managers can be usefully engaged in an interactive, reciprocating process in building resource-based theory. Following the Oxford Research Group, managers could be invited to attend management research seminars to interact with researchers in the knowledge-creation process. As Weick notes: 'we should pay just as much attention to problems defined by theorists as those defined by practitioners' (1989, p. 521). Following these suggestions seriously can have a profound impact on management research practices.

Future Research Building on Penrose's Resources Approach

Finally, we discuss some important topics for further inquiry using Penrose's resources approach. First, we suggest further research focusing on the role of well-functioning top-management teams for achieving superior economic returns. Executives who co-operate among themselves, i.e. seek and give advice to each other and share the risks, are more likely to recombine resources creatively to produce unique firm capabilities and competencies. In our search for sources of long-term superior returns, there is a need to study the processes of formation, evolution and replacement of management teams, and to show how these managerial processes interact with strategy formulation, implementation and performance. For example, one application could be examining the role and impact of management teams in the formation and implementation of networks and alliance activities, and the overall success of alliances, areas of inquiry that Penrose (1995, pp. xix–xx) emphasizes as needed extensions to her classic text.

Second, Penrose (1959) emphasizes the role of effective and innovative use of human resources in the creation of unique, valuable services, and hence superior economic returns. We can approximate a firm's knowledge base by looking at its human resource profile (Chang, 1996). Moreover, human resource management in resource-based theory is beginning to develop within strategic management (Coff, 1997; Farjoun, 1998; Kamoche, 1996). Human resource management requires analysis concerning: (1) articulating a strategic vision; (2) enacting organization environment; (3) creating internal labour markets; (4) investing in firm-specific human capital; (5) harnessing innovation and entrepreneurship; and (6) fostering organizational learning (Lado and Wilson, 1994). In an important Penrosean sense, human resource management provides independent variables needed to understand sources of competitive advantage.

The missing link in strategic management that has started to capture attention connects human resource practices and a firm's ability to gain and sustain the growth of firm-specific knowledge embedded in both individuals and learning teams. People are the learning resources of the firm, and, as Barnard (1938) noted, it is one of the crucial functions of the executive to achieve the continuance of valuable and distinctive contributions of employees. It is important for resource-based researchers to investigate the relationship between different bundles of human resource practices and a firm's ability to learn, innovate and grow profitably. Rewarding entrepreneurship among human resources helps develop unique firm capabilities, and this heterogeneity of resources and capabilities will have a strong endogenous influence on the strategy adopted (Langlois and Robertson, 1995).

Table I. Research questions for modern management theory and practice inspired by Penrose

<i>Original idea from Penrose</i>	<i>Research questions inspired by Penrose (1959)</i>
1 Firm growth is a dynamic process of management interacting with resources.	<ul style="list-style-type: none"> • How does the interaction of managers and other human resources influence a firm's growth and competitive advantage? • How does management of the firm's repository of knowledge influence the firm's growth and competitiveness?
2 Firms are created by people to serve the purposes of people.	<ul style="list-style-type: none"> • Under what circumstances are the purposes of rent maximization and growth maximization in conflict? • How do firms that have a stakeholder approach differ in competitiveness, commitment and strategic flexibility from firms that maximize stockholder wealth?
3 Services of resources are drivers of firm heterogeneity.	<ul style="list-style-type: none"> • Why are firms different in resources, capabilities and performance? • Do firms with similar resources follow similar strategies? • What sources of firm heterogeneity are drivers of performance differences both within and across industries? • How can networks and strategic alliances be formed and organized to share and/or co-develop capabilities?
4 Material resources and human resources create the subjective productive opportunity set for each firm.	<ul style="list-style-type: none"> • What incentives and persuasion methods effectively motivate human resources to learn continuously, develop multiple skills, and use their creativity? How do human capital, organizational capital and social capital interact? • In what systematic way does a firm's resource profile influence the dominant logic of management?
5 Firm growth is a function of firm-specific experiences in teams.	<ul style="list-style-type: none"> • What is the role of the top-management team on the rate and direction of firm growth? • How does long-term, top-management experience in teams create value for the firm?
6 Managerial capability is the binding constraint that limits the growth rate of the firm.	<ul style="list-style-type: none"> • How do fast-growing firms handle their short-run shortages of managers in different industries? • What are the implications for firm growth of developing managers internally versus hiring them externally? • Under what circumstances can availability of financial resources constrain the growth of the firm?
7 Excess capacity of productive services are drivers of firm growth.	<ul style="list-style-type: none"> • Under what circumstances are problems of excess capacity (i.e. underutilized productive services of resources) solved by market mechanisms and when are there market failures? • How do we define and identify excess capacity in intangible resources such as trademarks, managerial knowledge and capabilities?
8 Unused services of resources can be a source of innovation.	<ul style="list-style-type: none"> • What is the process of innovation for firms in maturing and declining industries? • What are the key success factors for turnaround strategies?
9 Firm diversification is often based on a firm's competencies that can lead to a sustainable competitive advantage.	<ul style="list-style-type: none"> • Which corporate strategy succeeds in which business environment? What is the best sequencing for leveraging and stretching resources? Does the environment matter at all? • To what extent can firms that stretch their resources gain competitive advantage by developing strategic flexibility and increased innovativeness in the long run?
10 Experimentation is an important component of the competitive process.	<ul style="list-style-type: none"> • What are the costs and benefits of strategic experimentation (e.g. experimenting in new alliances, new organizational designs, new products, new markets etc.)? Do firms with a first-mover strategy (e.g. firms that come up with inventions and test them in the marketplace first) perform better (in the short run and long run)?

Research explaining why firms are different is timely for addressing one of the 'fundamental questions in strategy' (Rumelt et al., 1994, p. 39). In table I, we update Penrose's research agenda to connect with modern resource-based theory.

Finally, in order to find comprehensive and rigorous answers to the questions Penrose (1959) posed concerning firm growth processes, more conceptual and especially empirical research needs to be done on the dynamics of growth, that is analysing the paths and the effects on the outcome of different sequences in the growth process. The interactions among management resources, diversification and learning of resources over time need to be studied closely to understand how and why firms grow in certain directions, rates and patterns.

In summary, this paper has concentrated on Penrose's research classic that has enjoyed long-lasting relevance to management from the late 1950s until the present (as the references at the end of the current paper indicate). We have focused on making the following contributions to the rapidly growing resource-based literature: (1) mapping out Penrose's research process leading to her classic; (2) spelling out Penrose's (1959) major research contributions in a more systematic way than is currently available in the resource-based literature; (3) fully updating the generative nature of Penrose's research for modern resource-based theory; (4) connecting Penrose's ideas to some current and some new questions for resource-based theory (in table I); and (5) suggesting some new areas of emphasis for resource-based theory. Following Penrose (1959) as an exemplar, we make the case that the knowledge-creation process is facilitated by an interactive, reciprocating process where generalized theories of researchers and contextual theories-in-use of managers may evolve in a dynamic research process.

NOTES

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[1] This assertion on the impact of Penrose's (1959) classic is supported by the fact that almost all references at the end of this paper that have been published *after* 1959 cite Penrose's *The Theory of the Growth of the Firm*. It is noted that almost all references at the end of this paper that were published *before* 1959 were cited by Penrose as influential to the development of her book, which was the starting point of our research. Our research involved a fairly exhaustive review of the pre-1959 literature that Penrose cites as influential in order to understand how Penrose connected and developed deductive economic theories with inductive business histories. Following in Penrose's footsteps, we organized the post-1959 literature that cites Penrose by connecting deductive modern resource-based theory with inductive business histories. Our arguments were then refined through feedback from colleagues, seminar participants and referees' critiques and suggestions in developing our account of the antecedents and consequences of Penrose's (1959) classic.

[2] Penrose was well known for her precise, logical thinking. O'Brien notes: 'Among her many friends, colleagues, and students, Edith will always be affectionately recalled for her style of vigorous, frank and democratic engagement in academic discourse.'

Her sharp and acute intelligence could be readily engaged in the correction of evasive and illogical thinking of any kind' (1997, p. 643). We argue that Penrose (1959) satisfies all of the criteria for theory building set out by Whetten (1989). Penrose's classic provides: (1) *what* factors (concepts, constructs and variables) that logically should be considered as part of an explanation of the growth rate of the firm; (2) *how* these factors are interrelated (i.e. introducing causality); and (3) *why* these factors are important (i.e. providing the logic and theoretical glue underlying psychological and economic dynamics to justify the selection of factors and the proposed causal relationships).

- [3] Interestingly, the connections among managers, resources and services of resources were being worked out independently by Chandler (1962) in his classic book, *Strategy and Structure*. Penrose, looking back on her book 25 years later observed: 'The analytical structure within which [Chandler's (1962)] historical analysis was cast was remarkably congruent with my own work, using much the same concepts and very nearly the same terminology at many points . . . We have here an illustration of a well-known phenomenon in the history of ideas and inventions: not infrequently innovations are made by two or more individuals working with different points of view and independently of each other' (1985, p. 5). Similarly (in a letter addressed to the second author of the current paper, dated 11 May 1993), Chandler writes: 'Incidentally, at the Business History Conference here in Boston a few weeks ago, I met Edith Penrose. We had a number of discussions. It was interesting that her approach and mine were diametrically opposite, but that our findings had similarities. She came to conclusions through deductive economics and I came to mine through inductive historical study.' In the current paper, we observe (along with Chandler) that Penrose's book is written in the style of deductive economic theorizing. However, we also wish to highlight Penrose's research process which was informed by inductive historical study as well.
- [4] Penrose states: 'it will be argued that [firm] size is but a by-product of the process of growth, but that there is no "optimum", or even most profitable, size of firm' (1959, p. 2). Williamson (1985, pp. 131–5) considers some of the potential limitations on the *size* of the firm, including: communication distortions, the inability of 'selective intervention', bureaucratic insularity, and incentive limits of the employment relationship. Penrose (1959) argued, however, that organizational innovations have the potential to overcome limitations on the size of the firm.
- [5] Concerning a definition of resources, Penrose suggests: 'for convenience alone resources are grouped under a few heads – for example, land, labour and capital – but . . . the sub-division of resources may proceed as far as is useful . . . for the problems at hand' (1959, pp. 74–5). Modern resource-based theory suggests groupings of resources that include: knowledge assets, sunk cost commitments (resource position barriers), reputational resources (including brand names), and second-order resources (dynamic capabilities). One of the 'problems at hand' for modern resource-based theory is to account for the creation, capture and sustainability of rents via resource-based competition (Mosakowski and McKelvey, 1997). Modern resource-based theory places more emphasis on analysing sustainable rents than analysing firm growth, although the latter topic also receives considerable attention (e.g. Chatterjee and Wernerfelt, 1991; Montgomery and Hariharan, 1991; Montgomery and Wernerfelt, 1988). Clearly the objectives of maximizing rents and maximizing firm growth are related, but, as Slater (1980b) demonstrates, the rent-maximizing and growth-maximizing firms will, in general, not adopt the same pricing/output policy in the short run. Agency problems may also lead to growth maximization rather than rent maximization and Penrose notes that while the neglect of such potential agency problems 'seemed to be a reasonable assumption at the time [of the book], it is now, some 40 years later, clearly inadequate' (1995, p. xi).

- [6] Schumpeter (1951, p. 217) defines a firm's adaptive response as actions 'within its existing practice' and a creative response as 'something that is outside of the range of existing practice'. Schumpeter also notes that 'a study of creative response in business becomes coterminous with a study of entrepreneurship' (1951, p. 217).
- [7] Fundamental concepts in the development of corporate strategy have parallels with Penrose's resources approach. For example, Andrews emphasizes the importance of matching 'opportunity to competence, once each has been accurately identified and its future significance estimated. It is this *combination* which establishes a company's mission and its position in its environment' (1980, p. 68). Ansoff stresses the need for a firm to develop its 'competence profile' (1965, pp. 97–102) for the purpose of internal appraisal, external appraisal, synergy appraisal and evaluation of opportunities.
- [8] Babbage argued: 'When (from the peculiar nature of the produce of each manufactory) the number of processes into which it is most advantageous to divide it is ascertained, as well as the number of individuals to be employed, then all other manufactories which do not employ a *direct multiple* of this number, will produce the article at a greater [unit] cost' (1832, pp. 68–9).
- [9] We argue here that organizational capital can satisfy all four criteria of the 'cornerstones of competitive advantage' (Peteraf, 1993). Organizational capital provides: (1) a source of heterogeneity (Nelson, 1991); (2) *ex ante* limits to competition in factor markets (Barney, 1991); (3) *ex post* limits to competition, due, for example, to causal ambiguity, tacitness and social complexity (Dierickx and Cool, 1989; Rumelt, 1984); and (4) imperfect mobility of resources yielding quasi-rents (Peteraf, 1993).
- [10] Almost all of the research provided in this section cites Penrose (1959) as foundational. Although a case can be made that modern resource-based theory developed out of the interaction at UCLA between economists and strategy scholars such as Alchian, Barney, Conner, Demsetz, Ouchi and Rumelt, this paper's 'rational reconstruction' emphasizing the centrality of Penrose (1959) in the actual historical development of resource-based theory can be readily defended by following the seminal works of Teece (1980, 1982) and Wernerfelt (1984). (For further discussion on this point, see Foss, 1997a, p. 14).
- [11] Itami and Numagami describe logical compound synthesis in the following way: 'Just like chemists synthesize various materials into some chemical compounds that are new to the world, researchers of this approach pick up various theoretical concepts and empirical findings and synthesize them into a plausible logical story. This approach derives its plausibility from the robust coherence among its component stories and reveals logical connections among conceptual constructs' (1992, p. 133).
- [12] In addition to Penrose's approach, the new institutional economics (e.g. Coase, 1937, 1988 and Williamson, 1975, 1996) also draws from good business practices. Few would argue – certainly we do not – that Penrose's approach is the *only* way to produce generative research. However, this paper does provide evidence that Penrose's approach is a fruitful path for producing deductive theorizing with immediate practical relevance. A limitation of Penrose's approach is that it may not satisfy the positivist criterion of providing the most parsimonious theory that predicts well. Another limitation, pragmatically speaking, is that the incentive systems in research universities can make theoretical pluralism and methodological triangulation a risky research agenda during the early years of the research scholar. However, with this associated risk, Penrose's approach can have high research returns by providing explanation and prediction that can have an important impact for producing good theory and informing good business practice.
- [13] Penrose's deductive skills were influenced by her wide readings on reconstructed (deductive) theories in economics. Influential works included: Bain (1956); Boulding (1950); Clark (1923); Dorfman (1951); Harrod (1952); Hicks (1939); Kaldor (1934);

- Kalecki (1937); Knight (1921); Lerner (1944); Machlup (1952); Marshall (1920); Robinson (1932); Robinson (1956); Stigler (1950); and Young (1928).
- [14] Evered and Louis submit: 'Our ability to grasp the breadth, depth, and richness of organizational life is hampered by allegiance to a single mode of inquiry' (1981, p. 393). Itami and Roehl (1987) provide a modern exemplar of the Penrosean resource-based approach using multiple levels of inquiry that combine (reconstructed) economic logic and the theories-in-use of managers.

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