

Chapter 1

Cumulative Causation as Explanatory Theory for Innovation

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ABSTRACT

While numerous theories have been used to explain innovation, one found to be useful in recent years is cumulative causation. Its major focus on incremental and evolutionary change, the path dependent nature of change, and its circular and cumulative effects, make it particularly useful in helping to explain innovation. In this chapter the literature on cumulative causation theory is reviewed to highlight links between these characteristics of the theory and innovation, as well as influences such as problem solving, learning by using and doing, collaboration, specialisation and the clustering of industry in certain locations. These characteristics and influences are then used as a basis for reporting empirical research into the nature of innovation in manufacturing and processing in an Australian rural region, and the usefulness of the theory for explanatory purposes is evaluated.

CUMULATIVE CAUSATION AS EXPLANATORY THEORY FOR INNOVATION

While a number of theories have been used to explain how innovation occurs and develops within organisations, one that has been found to be useful in recent years is cumulative causation. Although it had its origins in the late nineteenth and early twentieth century writings of Veblen (1899) and Young

(1928), it was expanded in the mid-twentieth century by writers such as Myrdal (1944; 1957) Hirschman (1958), Kaldor (1966; 1970, 1972) and others to discuss economic growth in developing countries. In the latter part of the twentieth century it was refined to explain a range of economic, geographic and social issues. Its major focus on incremental change, its path dependent nature, and its cumulative effects, combined with its use in explaining technological change, make it particularly useful in helping to explain innovation.

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One of the advantages of cumulative causation as an explanatory theory is that it is a “multi-causal” approach, avoiding emphasis on any single factor, and drawing attention to complex interactions between variables (O’Hara 2008, 376). Similarly, Argyrous (1995, 113) points out that its methodology differs from that of traditional explanatory approaches such as neoclassical theory in that “rather than unidirectional causality from independent to dependent variables, each variable interacts with the others in a mutually dependent way.”

Berger (2008, 358-359) draws attention to the writing of Kapp 1961, 188) who warned against attributing primary causation to economic factors alone, arguing that all relevant factors, as well as the reciprocal relationships between cause and effect, needed to be taken into consideration. Berger (2008, 359) goes on to argue that “the relevant factors can, of course, only be determined empirically in a given situation.” However, Berger and Elsner (2007, 535) caution that the various factors are reciprocally interlinked in an “uneven and complex manner,” and that these links are “in constant flux and mutually overlap.” They argue that policymakers need to simultaneously take account of variables such as institutions, education and technology.

In the following section, the literature on cumulative causation theory is reviewed to highlight the aspects relating to technological change and innovation. Key factors and influences identified in the literature are used as a basis for reporting empirical research into the nature of innovation in regional manufacturing and processing, and the usefulness of the theory for explanatory purposes is evaluated.

THE CONCEPT OF INNOVATION IN CUMULATIVE CAUSATION THEORY

Innovation has been described within a cumulative causation framework in terms of “technical progress,” being “a very complicated process emerging

from the learning activities of human beings, and the application of this learning activity to production” (Pasinetti 1981, 67). Pasinetti saw innovation as not simply a matter of new inventions, but also involving other activities in the workplace such as re-organising old methods of production, making better use of materials, improving the quality of products, applying new methods of production, producing new products, finding new resources and discovering new sources of energy.

Innovation has also been described as a process of solving problems that emerge in the workplace. As solutions to particular problems are incorporated into work practices and diffused into the economy, they generate new problems that need to be solved (Argyrous 1995, 110). Innovation also emerges from “learning by using and doing,” where advances in scientific knowledge are not enough on their own to achieve technical progress, but need to be followed up with “repeated application of particular engineering principles” to refine new techniques and processes (Kaldor 1972, 184; Targetti 1992, 166). Ricoy (1988, 732) refers to this as “the accretion of experience.” In solving problems and seeking better ways to operate, workers often develop new tools, generating their own capital equipment. Examples of this in the Australian machine tool industry have been described by Argyrous (1995, 104). Toner (2000, 23) highlights the learning aspects of innovation, particularly where technological innovation becomes incorporated into vocational training, and is further diffused into industry as a form of “public knowledge.”

Cumulative causation theory incorporates the idea that innovation through the development of new technology is an incremental or evolutionary process that depends on past developments (Argyrous and Sethi 1996, 487). O’Hara (2008, 376) points out that the acquisition of knowledge and technical skills, together with the associated development of economies of scale, “affect the path of development in complex and multifarious ways.” While it is accepted that there are occasions

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