



Population ecology theory: implications for sustainability

Manjula S. Salimath and Raymond Jones III

*Department of Management, College of Business, University of North Texas,
Denton, Texas, USA*

Abstract

Purpose – The paper has dual objectives. First, the paper aims to consolidate prior research in the area of population ecology theory and provide a review and critique of this influential organizational theory. The review is both broad and extensive, covering all major theoretical streams in population ecology. Second, the paper aims to highlight a new and hitherto unexplored area for future research, which lies at the intersection of population ecology and sustainability.

Design/methodology/approach – The extensive and broad review included all salient published scholarly work on the topic of population ecology from 1996-2010. Findings are reported in nine separate tables, classified by primary research focus, chronology, author, etc. Additionally, a brief summary of prior research on sustainability is provided.

Findings – Population ecology continues as a valuable and influential perspective for organizational scholars. In comparison, sustainability is a relatively new entrant in the organizational literature, since 2008. Several areas of convergence between population ecology and sustainability exist (construct dimensions, levels of analysis and outcomes). An important gap in the literature allows future research agendas to be pursued.

Practical implications – The major, and most widespread, global implication is that unsustainable organizational practices and strategies may be selected by ecological pressures, and that such organizations may face a decline in population density, or mortality. Sustainable practices may allow for greater firm density and a rise in survival rates for organizational populations. Future research directions investigating population ecology links to sustainability are provided.

Originality/value – This is the first instance where the potential contribution of population ecology to sustainability in organizations is provided.

Keywords Ecology, Population, Sustainable development

Paper type Research paper

Introduction

From a theoretical standpoint, population ecology has been a relatively influential theory that has provided scholars with a valuable tool in understanding macro organizational phenomena since mid 1970s. In this paper, we trace the usage of population ecology in both theoretical and empirical research, providing a broad and generalized review along with a critique of the theory. Since prior scholars have consolidated findings till 1996, our focus in the review is on studies from 1996 to 2010.

From a practical standpoint, the issue of sustainability in organizational practice has emerged as one of the most critical issues facing an organization in recent times. We believe that population ecology has valuable insights for sustainability in organizations, and that its potential to make contributions to sustainability research and practice are yet to be fully realized. Hence, in addition to the generalized review, we explore a novel and hitherto unexplored convergence of population ecology theory to sustainability practice.



In keeping with these dual aims of conducting a historical review and linking the theory to modern sustainable practice, our paper is structured in the following manner. First we provide an introduction to population ecology, its main assumptions, major theoretical streams, and criticisms. Second, we detail historically, in tabular format, extant research on the topic for approximately the past one and a half decades, i.e. 1996-2010. Third, we introduce the concept of sustainability, its importance and critical relevance to organizations. Finally, we outline the areas of convergence between population ecology and sustainability practice. We conclude the paper with implications and suggestions for future research.

Population ecology: assumptions and theoretical streams

In trying to answer the question – Why are there so many kinds of organizations?, population ecology challenges the view that individual organizations effectively and without consequence adapt to changes in the environment (Hannan and Freeman, 1977). Population ecology theory proposes that change occurs at the population level and is a result of the process of organizational selection and replacement (Carroll, 1988). An individual organization's survival is then based on environmental selection of those organizations that best fit their particular localized environment. Although, "adaptive change is not impossible, or even rare, but it is severely constrained" (Carroll, 1988, p. 2) at the individual organization level due to inert internal and external forces (Hannan and Freeman, 1977).

In examining populations of organizations the problem of setting population boundaries needs to be considered. One of the most widely used methods follows from the pioneering work of Hannan and Freeman (1977). Here organizational populations can be defined so that they have a unitary character (Amburgey and Rao, 1996) – members must have a common standing with respect to the processes of creation, dissolution, and transformation (Hannan and Freeman, 1989). While commonplace, this method has nonetheless been criticized. Critics suggest that organization ecology requires a more rigid scientific methodology, where classifications should be identified for each organization and population and those classifications should not change from one analysis to another (McKelvey, 1975).

Basic assumptions

Population ecology has several key assumptions that must be discussed first before a deeper examination of the research streams can be addressed. The first assumption is that organizational change occurs at the population level through organizational births and deaths (Hannan and Freeman, 1989). This does not mean that individual organizations cannot change. Organizations can and often do change, in sometimes, radical ways, but often the transformation can be extremely detrimental to organization survivability (Barnett and Carroll, 1995). Organizations adapt to their environment, and become institutionalized by retaining and reproducing their form. This in turn promotes growth and survival as long as the environment does not change. This institutionalization creates inertial forces against organizational change that does not allow the organization to adapt to the changing environment rendering the reliability and routines to be ineffective (Hannan and Freeman, 1984).

The idea of inertia is a second major assumption of population ecology, which states that the environmental selection favors organizations with high level of inertia

(Hannan and Freeman, 1984). To achieve high levels of inertia, an organization must have high levels of reliability and accountability, which in turn help to create high reproducibility (standardized routines). High levels of reproducibility generate strong inertial pressures. Again, the inertial pressure makes it difficult to change organization core structure and therefore increase survivability (Hannan and Freeman, 1984). While inertia makes it difficult to change form, only organizational changes that negatively affect an organization's accountability, reliability, and reproducibility increase mortality rates, whereas smaller peripheral changes in organizational features may actually enhance performance (Haveman, 1992; Greve, 1999).

Theoretical streams of research in population ecology

Though we find a vast array of research streams within population ecology, it is still said to have the greatest theoretical and methodological consensus within organizational studies (Pfeffer, 1993). Through these different research streams, population ecology has become a quantitative study of organizational vital rates (founding, growth, and mortality) that emphasizes the force of external selection over internal adaptation (Van Witteloostuijn, 2000). In the study of these vital rates there are several key categories where most population ecology research can fit. Specifically, these categories are; organization founding, organization mortality, niche-width, liability of newness and smallness, resource partitioning, density dependence, organizational change, and population dynamics (identity and demography) (Freeman and Hannan, 1989; Singh and Lumsden, 1990; Amburgey and Rao, 1996; Van Witteloostuijn, 2000). Each of these theoretical streams is described in greater detail in the following.

Organizational founding

Examining organizational founding is useful for the ecological perspective as it helps to identify the new organizations forms that are being selected in. In identifying founding rates, research has predominately focused on the time of creation of operating entity (Delacroix and Carroll, 1983) or incorporation. Although there have been some studies that focus on organizing attempts. Research on organizational founding is essential for organizational studies in terms of organizational forms, but it has also been a very useful tool for the study of entrepreneurship and offers many areas for future research in entrepreneurship from an ecological perspective (Carroll and Khessina, 2005).

Organizational mortality

Organizational mortality has been the predominant focus of researchers, within which are several more narrowly focused research streams as described in the following:

Niche-width theory. Fitness has most notably examined from a niche perspective, which is defined by Hannan and Freeman (1977) as "the area in constraint space (the space whose dimensions are levels of resources, etc.) in which the population out competes all other local populations" (p. 947). This has been studied using the niche-width theory that specifies under what specific conditions generalist or specialist strategies attribute to greater levels of survivability (Hannan and Freeman, 1977). This model predicts that specialists have the advantage in stable environments and occupy narrow niches (Popielarz and Neal, 2007). Generalists then occupy wide niches and are

favored in variable environment. This model holds except when the environment frequently changes between fine and coarse-grained states. Fine-grained variations are many small periodic variations and coarse-grained variations are fewer large periodic variations (Hannan and Freeman, 1977). These predictions have been empirically validated by Freeman and Hannan's (1983, 1989) examination of death rates in restaurants and semiconductor manufacturers. Although, more recently the model has been revised (Popielarz and Neal, 2007) such that the niche-width dichotomy of fine and coarse grained variations has now become a continuum on which environmental variations fall (Bruggerman and O'Nuallain, 2000).

Liability of newness. According to Stinchcombe (1965), due to liability of newness, new organizations have a propensity for higher failure rates, which can occur because of internal and external forces. Hannan and Freeman (1984) further explain that the selection process favors high levels of reliability and accountability in organizations as they produce high reproducibility. Reproducibility of organization structure increases with age as processes of internal learning, coordination, and socialization within the organization and external legitimacy become more routine (Singh and Lumsden, 1990). As greater reproducibility leads to greater inertia, organizations become more inert with age (Hannan and Freeman, 1984). Since selection favors organizational inertia (Hannan and Freeman, 1984), mortality rates decrease with age. The liability of newness construct has been empirically validated in numerous studies such as research on newspapers in Argentina and Ireland during the nineteenth and twentieth centuries (Carroll and Delacroix, 1982) and in research that analyzed 56 populations from retail stores to chemical manufacturers (Carroll, 1983).

Resource partitioning. Another research stream within the fitness model is Carroll's (1985) resource partitioning theory. The basic hypothesis states that increasing market concentrations among generalists opens opportunities in peripheral markets for specialists (Carroll *et al.*, 2002). There are several assumptions in resource partitioning theory such as the following:

- the resource in the market are scarce and finite;
- resources are concentrated at the market center;
- firms realize economies of scale in production, marketing, and distribution; and
- the ability to adapt to market conditions is limited (Vermeulen and Bruggerman, 2001).

Empirically this model has also been validated in Carroll and Swaminathan's (2000) study of microbreweries and brewpubs, where they were founded at higher rates and failed at lower rates as the mass production became concentrated among a few large generalist organizations (Popielarz and Neal, 2007). This model focuses on efficiency interpretations and is based on the notion that environmental and market conditions will be determining factors in which organizational forms will outperform others by virtue of market compatibility and not internal efficiencies (Carroll, 1993).

Liability of smallness. Another related area of research under the organization mortality stream examines organizational size and its effect on mortality rates. Aldrich and Auster (1986) offer several insights into reasons for the liability of smallness. Smaller organizations may have difficulty raising capital. Governmental regulation might have more of an impact on smaller organizations than larger ones. Smaller

organizations also may not have the ability (especially at the time of founding) to offer the stability that larger organizations can provide. It should be noted that adjusting for size did not diminish the effect of aging on mortality in study of newspaper firms, semiconductor manufacturers, and labor unions.

Density dependence

The density dependence model holds that founding and mortality rates in organization populations are a function of the number of organizations existing in populations at any given point in time (Hannan and Carroll, 1992). The original density dependence model included the processes of competition and legitimation as functional in representing population density (Hannan, 1986). The density dependence model is based on non-economic or non-efficiency drives such as density dependent legitimation and competition (Hannan, 1986). Density dependence is important both in the terms of organization founding and mortality. Patterns in founding rates can be affected by prior organizational founding, and failures in the population can be affected on the availability of resources (Delacroix and Carroll, 1983). The available resources could go to the new organizations, but an increase in failures could also signal resource scarcity in that particular environment and discourage new foundings (Singh and Lumsden, 1990). Density has a non-monotonic effect on founding rates (i.e. at low density, legitimation increases founding rates, but at high rates of density, competition leads to declining founding rates). This model has also been applied to competition between populations by a cross-population density mode (Hannan and Freeman, 1988a). Empirically the density dependence model has been validated in numerous studies and populations, including labor unions, which found the predicted non-monotonic effect of density on rates of founding (Hannan and Freeman, 1987) and mortality (Hannan and Freeman, 1988a). The model also held for semiconductor manufacturing (Brittain and Wholey, 1988; Hannan and Freeman, 1989), founding and mortality of local telephone companies (Barnett and Carroll, 1987), voluntary social service organizations (Tucker *et al.*, 1988), and the expansion and contraction of populations of educational organizations (Nielsen and Hannan, 1977; Carroll, 1981).

Population dynamics

Population dynamics includes several other area of research within population ecology. These perspectives include examining the identity, diversity, and demography of organizations (Carroll and Hannan, 2000a; Hannan, 2005, Hsu and Hannan, 2005). This stream of research looks to define organization populations.

Another grouping of studies has examined effects on populations from exogenous changes (Van Witteloostuijn, 2000) such as political turbulence (Carroll and Delacroix, 1982; Delacroix and Carroll, 1983; Carroll, 1987), localized competition, mass-dependent competitive intensity (Barnett, 1997), inter-population mutualism (Barnett and Carroll, 1987), strategic groups (Carroll and Swaminathan, 1992), technological change (Podolny and Stuart, 1995), human capital (Bruderl *et al.*, 1992), and multi-market rivalry (Barnett and Hansen, 1996) legal changes in status of labor unions (Hannan and Freeman, 1987, 1988b), and funding for social services (Singh *et al.*, 1986a, b).

Criticisms of population ecology

Population ecology has been criticized on many fronts (see, for example, Perrow, 1986; Young, 1988; Donaldson, 1995), and many of these criticisms have been the focus of open debate between organization researchers (Freeman and Hannan, 1989; Brittain and Wholey, 1989; Young, 1989; Zucker, 1989; Peterson and Koput, 1991). This also includes several syntheses to identify the current state of the theory and future directions (Ulrich and Barney, 1986; Singh and Lumsden, 1990; Amburgey and Rao, 1996; Baum, 1996). Each of these works offers a unique perspective on population ecology although some central themes stand out such as lack of clear consensus on key constructs, the classification and nature of the populations being studied, the deterministic nature of ecological ideas (Singh and Lumsden, 1990), issues with application and methodology, lack of attention to organizational adaptation and change, and most notably issues surrounding the density-dependence model.

Lack of clearly defined constructs

A major critique of the population ecology model deals with the ambiguity and the lack discipline-wide consensus about definitions that surrounds key constructs (Young, 1988; Donaldson, 1995; McKinley and Mone, 2003). As Donaldson (1995) states “Population ecology is pursued through research literature which contains its own technical vocabulary, mathematical models and methodologies making it a research paradigm relatively inaccessible to other organizational scholars” (p. 3). For example, niches, inertia or rates of environmental change are difficult to measure or define precisely (Young, 1988). Lacking a precise definition of the construct, common conceptualization across the field is difficult and therefore generalizability between different contexts is not feasible (Young, 1988). On the other hand some argue that criticizing the lack of discipline wide definition is not useful because many constructs that are used in population ecology (e.g. birth and death rates) are used in other disciplines and do not have a “workable” definition in those fields as well (Singh and Lumsden, 1990). This perspective illustrates that it is more reasonable to determine that constructs have been adequately defined and conceptualized within the specific study context being examined (Singh and Lumsden, 1990).

Issues with application and methodology

Criticisms also lie with areas of application and methodology implemented by population ecologist scholars. One area of contention has to do with the classification of populations. There are two main schools of thought on the issue of population classification (Carroll, 1984a, b). The first, offered by Hannan and Freeman (1977), states that organizational forms should be defined within the context of the specific research problem. This is because organizations are not exactly alike and they may change from one investigation to another depending on the type of analysis. The second perspective, by McKelvey (1975), states that organization ecology requires a more rigid scientific methodology. Hence, scientific classifications should be identified for each organization and population and those classifications should remain unchanged from one analysis to another.

Another criticism deals with the mechanisms through which selection operates, since most population ecology studies seem content with an indirect measurement of selection through rates of organizational death. The question as McKinley and Mone

(2003) state is whether “selection is primarily the result of active environments operating on passive, inert organizations, the product of an interaction between active environment and active, but misdirected organizational adaptation efforts, or some other combination of events”.

An often-heard critique of population ecology has to do with the demography of the organizations be examined. It has been said that research focused only on examining smaller organizations because larger organizations are immune to the selection process (Astley and Van de Ven, 1983; Perrow, 1986). Perrow (1986) states that large organizations are the most important, because selection only applies to small organizations, which are insignificant compared to the changing effects of large firms. Along this same line of thought is the idea that selection can only be used in the study of competitive and market based competitive organizations, as public organizations such as the federal government will not be allowed to fail (Perrow, 1986). This is a very narrow criticism, as there have been numerous studies that have examined a broad range different sized organizations (for example, Hannan and Freeman, 1988a, b; Carroll, 1987; Haveman *et al.*, 2007). Power organizations have also been examined and addressed with several studies examining size dependence (Carroll, 1984a, b; Wholey *et al.*, 1992), dominance in technological systems (Barnett, 1990) and size-based segmentation of populations (Amburgey *et al.*, 1994).

There are several of criticisms dealing with the application and methodology used, which include some of the following. There is too much focus on large-scale quantitative studies and therefore there is a lack of detailed investigation and description into the organizations and industries being examined (Van Witteloostuijn, 2000). Studies on organizational founding are somewhat limited because they do not often include examination of unsuccessful founding attempts (Delacroix and Carroll, 1983). There has not been enough empirical evidence that identifies whether risk jeopardizes survival and how it interacts with performance and constrains the life chances of organizations. Also, there have been issues taken with the treatment of highly diversified organizations in terms of classification and population boundary definitions (Van Witteloostuijn, 2000)

Adaptation and organizational change

Accounting for and acknowledgement of an organization’s ability to change has also been an area that has seen several criticisms. It is said that population ecology is too deterministic and leaves no room for a voluntaristic approach (Astley and Van de Ven, 1983). Specifically, there is too much reliance on an excessively “reified” notion of the environment (McKinley and Mone, 2003). There is little acknowledgement that organizations sometimes penetrate and even enact their environments (rather than being selected for death or survival), and they also tend to neglect the internal structures of organizations (Astley and Van de Ven, 1983; Fombrun, 1988; Perrow, 1986; Young, 1988; Donaldson, 1995). This view is not solely incorrect, but the focus of population ecology is on selection and change at the population level, not the individual organizational level. Although, there have been some studies on the performance effect of organizational change (Amburgey *et al.*, 1993), and organizational learning (Bruderer and Singh, 1996; Ingram and Baum, 1997a). While change and adaptation are being examined by population ecology scholars, there are several areas for future research, including; the sources and effects of changes in goals, authority, and

technology on the life chances of organizations and their financial performance (Barnett and Carroll, 1995); how population-level learning processes facilitate adaptation and reduce mortality rates (Amburgey and Rao, 1996); examination of how adaptation and founding become competing risks for network organizational form (creating new organizational forms or adaptation of existing business units) (Amburgey and Rao, 1996); and more focus on whether industry evolution operates through replacement of one unchanging organizational form by another or through mutation of the members of one organizational form into another (Haveman, 1995)

Density dependence

Criticisms, debates, and reappraisal surrounding the density dependence model have been a major area of focus. This includes issues with failing to directly operationalize the institutional processes (e.g. legitimation) that are a major explanatory resource in the density dependence model (Zucker, 1989; Peterson and Koput, 1991). Specifically, it is argued that the process of legitimation and competition are not studied directly, instead only the models are tested, and therefore the link between legitimation, and competition have not been effectively made (Zucker, 1989). Carroll and Hannan (1989) replied to this argument by identifying that their indirect use of legitimacy is quite consistent with how institutional theories treat the concept. Another criticism is that just counting the number of organizations in a population does not take into account the idea that larger organizations may have a stronger competitive advantage (Singh and Lumsden, 1990). However, this has been address by introducing population mass density, where each organization is weighted by its size (Barnett and Amburgey, 1990). An unresolved aspect of density dependence concerns studies with predicted results for organizational founding but with discrepant findings for mortality (Tucker *et al.*, 1988). This may be due to that fact that data on the early history of populations are not available (Singh and Lumsden, 1990).

Review of extant research in population ecology

In this section, we move on to provide a historical review of prior research on population ecology. It must be noted that there have been several extensive reviews of population ecology since Hannan and Freeman (1977), which have outlined the main theoretical streams, empirical research, and critiques of the theory (Freeman and Hannan, 1989; Singh and Lumsden, 1990; Aldrich and Wiedenmayer, 1993; Amburgey and Rao, 1996; Baum, 1996; Van Witteloostuijn, 2000; Baum and Shipilov, 2006). These prior reviews have consolidated research findings in population ecology till 1996. A single review appeared in 2006, but the focus was on only two specific topics of population ecology.

Our purpose, therefore, was to add to these prior reviews by identifying salient research in the field of population ecology from the time frame of 1996 to 2010. Our review differs from previous reviews in another important way. Earlier reviews focused on only a few of the research streams within population ecology. In contrast, our review is fairly extensive, broad and generalized, as our approach was to compile works across all major population ecology research streams as identified earlier in the paper. For the sake of parsimony, and given that we were dealing with a vast array of studies, we provide our historical and extensive review in a tabular format that extends over nine separate tables. The tables are further separated out by theoretical, and

empirical studies, and topic, or focus areas. Hence, Table I shows theoretical work on various research topics within population ecology. The remaining eight tables summarize empirical work on each major research stream within population ecology such as organizational foundings (see Table II), organizational mortalities (see Table III), change at organizational and population levels (see Table IV), Niche theory (see Table V), resource partitioning (see Table VI), density dependence (see Table VII), studies on two or more key constructs in population ecology topics (see Table VIII) and studies on other varied constructs such as identity, growth, etc. (see Table IX).

As the nine tables reveal, it is evident that population ecology has continued to have an impact on the various theoretical streams since 1996. However, we did not find any prior research that addresses the topic of sustainability from a population ecology perspective. In the next section we discuss how population ecology can provide a new research agenda for sustainability practice in organizations.

Sustainability in organizations

Sustainability has become an issue of central importance and critical relevance to the survival and economic viability of organizations. The United Nations (1987) is credited with defining the term sustainability in the well known Brundtland Commission Report: "sustainable development is development that meets the needs of the present

Author(s)/year	Research focus	Approach	Population	Theory/ empirical
Baum <i>et al.</i> (2006)	Ecology and strategy	Synthesis	N/A	Theory
Carroll and Khessina (2005)	Entrepreneurship	Synthesis	N/A	Theory
Breslin (2008)	Entrepreneurship	Synthesis	N/A	Theory
Hannan <i>et al.</i> (2007)	First order logic for organization ecology	Synthesis	N/A	Theory
Galunic and Weeks (2002)	Intraorganizational ecology	Synthesis	N/A	Theory
Denrell and Kovacs (2008)	Population ecology – sampling issues	Synthesis	N/A	Theory
Beck (2008)	Population ecology and competition	Synthesis	N/A	Theory
Barron (2001)	Population ecology and industrial economics	Synthesis	N/A	Theory
Geroski (2001)	Population ecology and industrial economics	Synthesis	N/A	Theory
van Witteloostuijn and Boone (2006)	Population ecology and industrial economics	Synthesis	N/A	Theory
Baum and Amburgey (2002)	State of population ecology	Synthesis	N/A	Theory
Amburgey and Rao (1996)	State of theory	Synthesis	N/A	Theory
McKinley and Mone (2003)	State of theory	Synthesis	N/A	Theory
Scott and Davis (2007)	State of theory	Synthesis	N/A	Theory
Baum and Shipilov (2006)	State of theory	Synthesis	N/A	Theory
Swaminathan (1996)	State of theory	Synthesis	N/A	Theory
Swaminathan (1996)	State of theory – review of symposia	Synthesis	N/A	Theory
Barnett (2008)	The Red Queen effect	Synthesis	N/A	Theory

Table I.
Theoretical perspectives on various topics within population ecology (1996-2010)

Author(s)/year	Research focus	Approach	Population	Theoretical or empirical
Mascarenhas (1996)	Organizational founding	Density dependence and resource partitioning	Offshore oil-drilling industry, 1966-1984	Empirical
Mascarenhas and Sambharya (1996)	Organizational founding	Density dependence	World airline industry and global offshore drilling industry	Empirical
Baum and Haveman (1997)	Organizational founding	Density dependence	Manhattan Hotel industry, 1898-1990	Empirical
Dobbin and Dowd (1997)	Organizational founding		Massachusetts railroad firms, 1825-1922	Empirical
Messallam (1998)	Organizational founding	Population dynamics	Five Egyptian industries, 1974-1998	Empirical
Neilsen and Salkl (1998)	Organizational founding	Collective action	183 information offices in Europe	Empirical
Schulz (1998)	Organizational founding	Density dependence	Rule production in large US research universities	Empirical
Swaminathan (1998)	Organizational founding	Resource partitioning and niche formation	US brewing industry	Empirical
Baum (1999)	Organizational founding		Nursing home chains in Ontario, 1971-1996	Empirical
Fotopoulos and Spence (1999)	Organizational founding	Population dynamics	Three Greek manufacturing industries – consumer, intermediate and capital goods	Empirical
Harhoff (1999)	Organizational founding	Regional spillovers	West German industries, 1989-1993	Empirical
Lomi (2000)	Organizational founding	Density dependences	Danish commercial banks, 1846-1989	Empirical
Mezias and Mezias (2000)	Organizational founding	Resource partitioning	American feature film industry, 1912-1929	Empirical
Ruef (2000)	Organizational founding	Density dependence and organizational size	48 organizational forms in health care sector	Empirical
Dobrev (2001)	Organizational founding	Legitimation and political turbulence	Bulgarian newspaper enterprises, 1846-1992	Empirical
Phillips (2002)	Organizational founding		Silicon Valley law firms, 1946-1997	Empirical
Sine <i>et al.</i> (2007)	Organizational founding	Population dynamics in a specific niche	US independent power industry	Empirical
Ruef (2005)	Organizational founding	Entrepreneurship	591 entrepreneurs	Empirical
Audia <i>et al.</i> (2006)	Organizational founding		US instrument manufacturing firms, 1978-1988	Empirical
Kuilman and Li (2006)	Organizational founding	Identity formation	Foreign banks in Shanghai	Empirical
Lazzeretti (2006)	Organizational founding	Density dependence	Arezzo jewelers district, 1947-2001	Empirical

(continued)

Table II.
Studies focusing on
organizational founding
(1996-2010)

Table II.

Author(s)/year	Research focus	Approach	Population	Theoretical or empirical
Sine <i>et al.</i> (2007)	Organizational founding	Institutional perspective	US independent power industry, 1978-1992	Empirical
Khessina and Carroll (2008)	Organizational founding	Product demography	Optical disk drive industry, 1983-1999	Empirical
Stuart and Sorenson (2003)	Organizational founding	Density dependence	Biotechnology firms	Empirical
Sorenson (2000)	Organizational founding	Population level learning	American automobile industry	Empirical
Cattani <i>et al.</i> (2003)	Organizational founding	Population dynamics	Dutch accounting industry	Empirical

without compromising the ability of future generations to meet their own needs". Hence sustainability is concerned with balanced development along with ecological concerns that has important ramifications for both intra and inter-generational equity.

Sustainability also considers the inclusion additional criteria in the evaluation of business performance, such as the commonly known "triple bottom line". The term triple bottom line (Elkington, 1994) refers to the integration of ecological and social performance along with financial performance. It is also sometimes referred to as the three pillars of social, environmental and economic demands. Thus the combination of people, planet and profit effectively and simply describes the goal of sustainability.

Scholarly research on the topic of sustainable organizations is surprisingly limited. There is no consensus on a unified definition of sustainability. Furthermore, the measurement and interpretation of this construct appears to be idiosyncratic to specific aims or research interests. In addition, most of the published work seems to have occurred in the past two years (2008-2010) indicating the relative novelty of the topic in management and organizational sciences. Since a detailed discussion of prior sustainability literature is beyond the scope of the present paper, we provide a quick summary of salient scholarly research on the topic. The approaches to sustainability appear to be quite varied (Wikström, 2010), addressing the role of strategies (Loorbach *et al.* 2010), co-evolutionary perspectives (Benn and Baker, 2009), sustainability reporting (Milne *et al.*, 2009), green management (Pane Haden *et al.*, 2009) and 360-degree sustainability (Hollingworth, 2009). There have been attempts to introduce sustainability concepts to the management and logistics literature (Aras and Crowther, 2009; Carter and Rogers, 2008), sustainable global chains (Cruz and Boehe, 2008), conceptualizing a sustainability business model (Stubbs and Cocklin, 2008a, b), the role of leadership in practicing sustainability (Quinn and Norton, 2004), evolutionary processes of sustainability (Wilkinson and Cary, 2002), multilevel and system perspectives of ecologically sustainable organizations (Starik and Rands, 1995), and even sustainability during turbulent times (Edwards, 2009). Seager (2008) suggests that multiple perspectives are needed to understand the full spectrum of sustainability, while other scholars have considered either systems views (Starik and Rands, 1995) or ecological modernization perspectives (Pataki, 2009) to explain sustainability in organizations.

Author(s)/year	Research focus	Approach	Population	Theoretical or empirical
Ingram (1996)	Organizational mortality	Strategic perspective	US hotel chains, 1896-1980	Empirical
Welbourne and Andrews (1996)	Organizational mortality	HRM and performance	136 non-financial companies with an IPO in 1988	Empirical
Ranger-Moore (1997)	Organizational mortality	Size and age	New York life insurance companies, 1813-1985	Empirical
Silverman <i>et al.</i> (1997)	Organizational mortality	Transaction cost perspective	US interstate for-hire trucking industry	Empirical
Baum and Ingram (1998)	Organizational mortality	Organizational learning	Manhattan hotel industry, 1898-1990	Empirical
Lamertz and Baum (1998)	Organizational mortality	Downsizing	Media accounts, 1988-1995	Empirical
Pennings <i>et al.</i> (1998)	Organizational mortality	Combine resource-based view and population ecology	Dutch accounting firms, 1880-1990	Empirical
Ruef and Scott (1998)	Organizational mortality			Empirical
Zingales (1998)	Organizational mortality	Niche and Size	US trucking industry	Empirical
Doi (1999)	Organizational mortality	Liability of smallness	Japanese manufacturing industry, 1981-1989	Empirical
Henderson (1999)	Organizational mortality	Liability of newness – from a contingency perspective	US personal computer industry, 1974-1994	Empirical
Dowell and Swaminathan (2000)	Organizational mortality		US bicycle producers, 1880-1918	Empirical
Ingram and Simons (2000)	Organizational mortality	Institutional perspective	Israeli workers cooperatives, 1920-1992	Empirical
Barnett and Freeman (2001)	Organizational mortality		US semiconductor manufacturers	Empirical
Phillips (2001)	Organizational mortality	Employee promotion chances	Silicon Valley law firms, 1946-1996	Empirical
Shane (2001)	Organizational mortality		US business format franchise systems, 1984-1996	Empirical
Dobrev and Carroll (2003)	Organizational mortality	Organizational size		Empirical
Ruef (2004)	Organizational mortality		Plantation agriculture in the American South, 1860-1880	Empirical
Dobrev <i>et al.</i> (2006)	Organizational mortality	Population identities	Financial cooperatives in Singapore	Empirical

(continued)

Table III.
Studies focusing on organizational mortality (survival and failures) (1996-2010)

Author(s)/year	Research focus	Approach	Population	Theoretical or empirical
Nunez-Nickel and Moyano-Fuentes (2006)	Organizational mortality	Liability of size	Spanish olive oil industry, 1944-1998	Empirical
Sorenson <i>et al.</i> (2006)	Organizational mortality	Niche-width	Machine tool manufacturing, 1975-1995; computer workstation manufacturing, 1980-1996	Empirical
Strotmann (2007)	Organizational mortality	Liability of newness	German manufacturing sector, 1981-1994	Empirical
Mudambi and Zahra (2007)	Organizational mortality	Liability of newness – strategic perspective	275 British international new ventures	Empirical
Perrigot (2008)	Organizational mortality	Network survival	Franchising networks in France, 1992-2002	Empirical
Pindard-Lejarraga and Gutierrez (2010)	Organizational mortality	Liability of connectedness	Spanish Railway, 1848-1935	Empirical
Ingram and Baum (1997a)	Organizational mortality	Strategic perspective	US hotel chains, 1896-1980	Empirical
Ingram and Baum (1997b)	Organizational mortality		US hotel chains, 1898-1980	Empirical
Hannan <i>et al.</i> (1998a)	Organizational mortality		European and American Automobile industries	Empirical
Hannan <i>et al.</i> (1998b)	Organizational mortality		European and American automobile industries	Empirical
Khessina (2006)	Organizational mortality	Population dynamics	Disk drive industry, 1983-1999	Empirical
Hannan (1998)	Organizational mortality	Liability of newness – logical formalizations	N/A	Theoretical
Lomi and Larsen (1998)	Organizational mortality	Density delay model	Simulation of synthetic data	Theoretical
Swaminathan and Wade (1999)	Organizational mortality	Liability of newness and social movement theory	N/A	Theoretical
Polos and Hannan (2000)	Organizational mortality	First order logic for age dependence	N/A	Theoretical
Lomi <i>et al.</i> (2005)	Organizational mortality	Density dependence	N/A	Theoretical
Carayannopoulos (2009)	Organizational mortality	Overcoming with liability of newness disruptive technology	N/A	Theoretical
Christensen (1997)	Organizational mortality	Innovation	N/A	Theoretical

Table III.

Author(s)/year	Research focus	Approach	Population	Theoretical or empirical
Usher and Evans (1996)	Change	Founding, failure, and transformation	Canadian retail gasoline industry, 1059-1988	Empirical
Ruef (1997)	Change		California hospital industry, 1980-1990	Empirical
Dobrev (1999)	Change		Bulgarian newspapers, 1987-1990.	Empirical
Meeus and Oerlemans (2000)	Change	Innovation	Industrial firms in the North Brabant region of the Netherlands	Empirical
Sorensen and Stuart (2000)	Change	Organization age	Semiconductor industry, 1984-1992; Biotech industry, 1987-1994	Empirical
Baron <i>et al.</i> (2001)	Change		High-technology firms in California's Silicon Valley – The Stanford Project on Emerging Companies (SPEC)	Empirical
Dobrev <i>et al.</i> (2003)	Change	Niche	US automobile manufacturers, 1885-1981	Empirical
Hannan <i>et al.</i> (2006)	Change	Identity	High-technology firms in California's Silicon Valley – The Stanford Project on Emerging Companies (SPEC)	Empirical
Rhee <i>et al.</i> (2006)	Change	Niche-width	UK automobile manufacturers, 1894-1981	Empirical
McKendrick and Wade (2009)	Change		Floppy disk drive manufacturers, 1970-1989	Empirical
Winsor (1998)	Change	Integration of pop ecology and market integration	N/A	Theoretical
Peli <i>et al.</i> (2000)	Change	Logical formalization of structural inertia	N/A	Theoretical
Rao (2002)	Change	Interorganizational ecology	N/A	Theoretical
Hannan <i>et al.</i> (2004)	Change	Cascading change – reworking theory	N/A	Theoretical
Baum (2006)	Change	Institutional perspective	N/A	Theoretical
Gharavi and Sor (2006)	Change	Pop ecology and institutional perspectives	Australian travel agencies	Theoretical
Peli and Bruggeman (2007)	Change	Niche-width	N/A	Theoretical
Schwarz and Shulman (2007)	Change	Structural Inertia	N/A	Theoretical
Hannan <i>et al.</i> (2003a)	Change	Cascading change – reworking theory	N/A	Theoretical
Hannan <i>et al.</i> (2003b)	Change	Cascading change – reworking theory	N/A	Theoretical
Hannan (2005)	Change	Diversity and Identity	N/A	Theoretical
Greve (1999)	Change		N/A	Theoretical

Table IV.
Studies focusing on
change at organizational
and population levels
(1996-2010)

Author(s)/year	Research focus	Approach	Population	Theoretical or empirical
Podolny <i>et al.</i> (1996)	Niche	Development of organizational-specific niche	Semiconductor industry, 1984-1991	Empirical
Dobrev <i>et al.</i> (2001)	Niche-width and resource partitioning		European automobile manufacturing firms	Empirical
Massey (2001)	Niche-width		US airline industry	Empirical
Dobrev <i>et al.</i> (2002)	Niche and population dynamics		US automobile manufacturers, 1885-1981	Empirical
Hsu (2006)	Niche-width		US produced feature film projects, 2000-2003	Empirical
Haveman <i>et al.</i> (2007)	Niche-width		US wineries, 1940-1989	Empirical
Hsu <i>et al.</i> (2009)	Niche-width	Market specialization and social outcomes of products	eBay auctions and US feature-film products	Empirical
Bruggeman (1997)	Niche-width	Logical formalization of model	N/A	Theoretical
Peli (1996)	Niche	Rebuild theory using first order logic	N/A	Theoretical
Usher (1999)	Niche-width	Critique	Multi unit firms in a single industry	Theoretical
Bruggeman and O'Nuallain (2000)	Niche-Width	Criticism	N/A	Theoretical
Hannan <i>et al.</i> (2003)	Niche	Reworking theory	N/A	Theoretical
McPherson (2004)	Niche-width		N/A	Theoretical
Popielarz and Neal (2007)	Niche	Synthesis	N/A	Theoretical
Hannan (1997a)	Niche-width	Comment – logical formalization	N/A	Theoretical

Table V.
Studies focusing on niche theory (1996-2010)

These recent works seem to indicate an increasing trend towards greater understanding of sustainability issues in organizations. It is expected, that many fundamental, organizational, practices, and strategies, will be radically transformed, by the types of issues, that sustainability will bring to the management fields (Hopkins, 2009). Growing societal and economic understanding of sustainability is expected to foster changed practices such as sustainability designed workplaces, sustainability choices, sustainability profile and quality, sustainability outcomes, sustainability collaborations, and transparency on sustainability issues (Hopkins, 2009).

No doubt, sustainability will continue to be of relevance to future management of organizations. Recent evidences of unsustainable business practices and their detrimental effects on ecological environments, societal well being and economic considerations (e.g. Exxon-Valdez oil spill, British Petroleum under-ocean gas leakage)

Author(s)/year	Research focus	Approach	Population	Theoretical or empirical
Boone <i>et al.</i> (2000)	Resource partitioning		Dutch audit industry, 1896-1992	Empirical
Carroll and Swaminathan (2000)	Resource partitioning		US brewing industry	Empirical
Dobrev (2000)	Resource partitioning		Bulgarian newspapers, 1987-1990	Empirical
Park and Podolny (2000)	Resource partitioning	Combining with status-based model of market competition	US investment banking, 1920-1949	Empirical
Swaminathan (2001)	Resource partitioning	Organizational identity	US wineries, 1940-1990	Empirical
Boone <i>et al.</i> (2002)	Resource partitioning		Dutch national and regional newspapers, 1968-1994	Empirical
Boone <i>et al.</i> (2004)	Resource partitioning		Dutch national and regional newspapers, 1968-1994	Empirical
Greve <i>et al.</i> (2006)	Resource partitioning		Low power FM radio stations	Empirical
Archibald (2007)	Resource partitioning		Self-help/mutual-aid organizations 1955-2000	Empirical
Peli and Nooteboom (1999)	Resource partitioning	Market partitioning	N/A	Theory
Vermeulen and Bruggeman (2001)	Resource partitioning	Refining the theory	N/A	Theory
Carroll <i>et al.</i> (2002)	Resource partitioning	Synthesis of theory	N/A	Theory

Table VI.
Studies focusing on
resource partitioning
(1996-2010)

have raised the consciousness of multiple stakeholders and created a renewed impetus for recognizing sustainability impacts of organizational practices.

In the following section, we outline possible areas of convergence between sustainability and population ecology, and conclude with implications for future research on sustainability.

Population ecology and sustainability: a convergence

It is pertinent to note that one popular theoretical stream in population ecology, i.e. organizational change, reflects an ecological perspective to explain the diversity in organizations (Aldrich and Pfeffer, 1976; Aldrich, 1979; Hannan and Freeman, 1977; McKelvey, 1982). In this context, population ecologists attempt to account for the changes in the composition of organizations over long periods of time, by addressing “how social, economic, and political conditions affect the relative abundance and diversity of organizations” (Baum, 1996, p. 77). Ecological approaches to firm birth and death rates stress the environmental and contextual causes that affect opportunity structures and in turn cause variation in organization populations (Aldrich and

Table VII.
Studies focusing on
density dependence
(1996-2010)

Author(s)/ year	Research focus	Approach	Population	Theoretical or empirical
Barron <i>et al.</i> (1998)	Density dependence	Competitive intensity at system and population level – effects of regulation	US financial industry	Empirical
Barron (1999)	Density dependence	Vital rates and organizational size	Credit unions in New York City	Empirical
Greve (2002)	Density dependence	Introducing spatial evolution	Tokyo banking industry, 1894-1936	Empirical
Bogaert <i>et al.</i> (2006)	Density dependence		Dutch audit industry, 1884- 1939	Empirical
Dobrev and Kim (2006)	Density dependence	Population dynamics	US auto industry, 1895-1981	Empirical
Archibald (2008)	Density dependence		Self-help/mutual-aid organizations 1955-2000	Empirical
Hannan (1997b)	Density dependence		European automobile manufacturing firms, 1886- 1981	Empirical
Kuilman <i>et al.</i> (2009)	Density dependence	Logical formalization of the density delay model	N/A	Theoretical
van Wissen (2004)	Density dependence	Comparison	N/A	Theoretical
Carroll (1996)	Density dependence	Synthesis	N/A	Theoretical

Wiedenmayer, 1993; Carrol, 1984a; Romanelli, 1991). The considerations of social and economic conditions from an ecological perspective are closely aligned with the notion of triple bottom line of people, planet and profits that are essential for arriving at sustainability. Conceptually, both population ecology and sustainability converge in their consideration of these three separate but interrelated systems.

A second area of convergence is that both entail macro systems assumptions. Population ecology considers topics like survival and mortality at the macro population level. Likewise, sustainability, because it relies on balance between social, economic and ecological dimensions, is a systems level concept. As such, both operate at macro and not individual levels of analysis.

Population ecology specifies that organizational change at the population level basically reflects four basic processes of variation, selection, retention and competition (Aldrich, 1979; McKelvey, 1982). Organizations that can withstand these pressures will survive or be “selected into” the population, while the rest will be “selected out” or face mortality. From an outcomes perspective, this actually refers to the longevity or sustainability of these organizational populations. It is likely that ecological pressures of variation, selection, retention and competition, may in fact allow sustainable organizations the benefit of longevity and survival, while disallowing unsustainable populations from continuity. Sustainability assumptions likewise imply that a failure to consider the balance between social, economic and ecological criteria will generate unsustainable practices that have no chance for continuity in the long term. Herein is a third point of convergence, in that both the outcomes overlap significantly.

Author(s)/year	Research focus	Approach	Population	Theoretical or empirical
Carroll and Teo (1996)	Organizational change and mortality		American automobile producers, 1885-1981	Empirical
Paulino (2009)	Organizational change and mortality	Combining adaptation and selection theories	Space HROs	Empirical
Bigelow <i>et al.</i> (1997)	Organizational founding and density dependence		American automobile producers, 1885-1981	Empirical
Barron (1998)	Organizational founding and growth	Institutional legitimacy and density dependence	Credit unions and Morris Plan banks, 1914-1934	Empirical
Barnett and Sorenson (2002)	Organizational founding and growth	Red Queen	Retail banks in Illinois, 1900-1993	Empirical
Barnett <i>et al.</i> (2000)	Organizational founding and growth	Generalist and specialist	US R&D consortia	Empirical
Haveman and Noonemaker (2000)	Organizational founding and growth		California savings and loan industry	Empirical
Klepper (2002)	Organizational founding and growth	Liability of newness	US automobile industry 1895-1966	Empirical
Bayus and Agarwal (2007)	Organizational founding and growth		US personal computer industry, 1974-1994	Empirical
Patzelt and Audretsch (2008)	Organizational founding and growth	Environmental turbulence	German biotech industry, 2002-2004	Empirical
Geroski <i>et al.</i> (2010)	Organizational founding and growth	org ecology and resources-based view perspectives	New firms in Portugal, 1983-993	Empirical
Ingram and Inman (1996)	Organizational founding and mortality		Hotels in Niagara Falls area, 1885-1991	Empirical
Swaminathan (1996)	Organizational founding and mortality	Environmental conditions	US Brewing industry and Argentine newspaper organizations	Empirical
Barnett (1997)	Organizational founding and mortality	Organizational growth and strength, competitiveness	US Breweries and PA Telephone Companies	Empirical
Wade <i>et al.</i> (1998)	Organizational founding and mortality	Institutional effects	American brewing industry, 1845-1918	Empirical
Carroll and Teo (1999)	Organizational founding and mortality		Commercial Banks in Singapore, 1840-1994	Empirical

(continued)

Table VIII.
Studies with a research focus on two or more key constructs of population ecology (1996-2010)

Author(s)/year	Research focus	Approach	Population	Theoretical or empirical
Ilmakunnas and Topi (1999)	Organizational founding and mortality	Population dynamics	Finnish manufacturing industry	Empirical
Sorenson and Audia (2000)	Organizational founding and mortality	Density dependence – geographical concentration	US shoe manufacturing, 1940-1989	Empirical
Horvath <i>et al.</i> (2001)	Organizational founding and mortality	Population dynamics	US beer brewing industry, 1880-1890	Empirical
Kaya and Ucdogruk (2002)	Organizational founding and mortality	Population dynamics	Turkish manufacturing firms, 1981-1997	Empirical
Disney <i>et al.</i> (2003)	Organizational founding and mortality	Population dynamics	UK manufacturing establishments, 1986-1991	Empirical
McKendrick <i>et al.</i> (2003)	Organizational founding and mortality	Population identities and density	Disk array industry	Empirical
Dowell and Swaminathan (2006)	Organizational founding and mortality		US bicycle producers, 1880-1918	Empirical
Barnett and Pontikes (2008)	Organizational founding and mortality	Organizational change	US computer industry, 1951-1994	Empirical
Zaring and Eriksson (2009)	Organizational founding and mortality	Density dependence and age	Sweden IT industry, 1990-2004	Empirical
Carroll <i>et al.</i> (1996)	Organizational founding, growth, and mortality		American automobile producers, 1885-1981	Empirical
Roberts and Thompson (2003)	Organizational founding, mortality, and growth	Population dynamics	Polish manufacturing firms	Empirical
Martin-Marcos and Jaumandreu (2004)	Organizational founding, mortality, and growth	Density dependence	Spanish manufacturing industry, 1979-1990	Empirical
Ruef (2006)	Organizational founding, mortality, and growth	Entrepreneurship	US Medical Schools, 1765-1930	Empirical
Wezel and van Witteloostuijn (2006)	Organizational mortality and change	Organizational change	UK motorcycle industry, 1895-1993	Empirical
Becker (2007)	Organizational growth and change	Knowledge management	N/A	Theoretical
Peli (2009)	Organizational change and niche	Refine concepts of the Red Queen and inertia	N/A	Theoretical

Table VIII.

(continued)

Author(s)/year	Research focus	Approach	Population	Theoretical or empirical
Baum (1996)	Organizational founding and change	Synthesis	N/A	Theoretical
Freeman and Engel (2007)	Organizational founding and growth		N/A	Theoretical
Caves (1998)	Organizational founding and mortality	Turnover and firm mobility at country level	Country level analysis of primarily manufacturing organizations	Theoretical
Barnett and Pontikes (2005)	Organizational founding, mortality, learning	Red Queen effect and competition intensity	Illinois retail banks and worldwide disk drive manufacturers	Theoretical
Barnett and Sorenson (2002)	Organizational founding and growth	Red Queen	N/A	Theoretical

Table VIII.

It is indeed interesting to note that despite these potential areas of overlap, the intersection of population ecology and sustainability in organizations has failed to generate scholarly research to date. As our examination of prior extant work (see Tables I to IX) clearly demonstrates, this is a gap that is indeed worthy of future research. We hope to stimulate and begin the conversations in this newly identified area.

Implications and future research

Given that there are several probable areas of convergence; population ecology does have the potential to contribute significantly to our understanding of how sustainable organizational populations have a higher rate of survival. One major implication is that sustainability (in business practice and strategy) will be sustainable (or lead to firm founding and survival) and furthermore, that unsustainability (in business practice and strategy) is unsustainable (or leads to firm death and mortality).

Among avenues for future research, scholars can pursue a variety of research questions that lie at the intersection of population ecology and sustainability. For example, future research could examine whether and to what extent the population density of organizations may be affected by sustainable practices prevalent in the industry. Simulation models can be generated to assess the effect of evolutionary processes on sustainable and unsustainable business practices. Longitudinal studies that start from firm founding or inception are likely to be of greatest value in this area. However, cross sectional examination of successful (survivor firms) vs failed firms would also provide a rich arena to understand different antecedent conditions that may have causal or predictive variability.

In summary, we hope to motivate future research in a hitherto unidentified domain, i.e. the application of population ecology principles and assumptions to examine sustainability in organizations.

Author(s)/ear	Research focus	Approach	Population	Theoretical or empirical
Bruderer and Singh (1996)	Organizational growth	Organizational learning through organizational evolution and simulation	250 learning organizations	Empirical
Geroski and Mazzucato (2001)	Population dynamics		US car producers, 1902-1995	Empirical
Sandell (2001)	Organizational growth		Sweden social movement organizations, 1881-1940	Empirical
Zuckerman and Kim (2003)	Identity	Organizational growth	Feature film industry	Empirical
Zuckerman <i>et al.</i> (2003)	Identity	Organizational growth	Feature film labor market	Empirical
Bothner (2005)	Organizational growth	Organizational size	Global computer industry	Empirical
Ivery (2007)	Population dynamics	Collaborative partnerships	Tri-cities partnership	Empirical
Negro <i>et al.</i> (2008)	Identity	Niche width	US Winemaking industry	Empirical
Soytas (2009)	Population dynamics		Turkish manufacturing firms, 1950-2000	Empirical
St-Jean <i>et al.</i> (2010)	Population dynamics	Entrepreneurial orientation	717 forestry small to medium-sized enterprises	Empirical
Zhou and van Witteloostuijn (2010)	Organizational growth	Institutional constraints and ecological processes	Chinese construction industry, 1993-2006	Empirical
Carroll and Hannan (2000a)	Population demography	Synthesis	N/A	Theoretical
Carroll and Hannan (2000b)	Population demography	Synthesis	N/A	Theoretical
Polos <i>et al.</i> (2002)	Identity	Using first order logic to define populations	N/A	Theoretical
Baron (2004)	Identity	Employment-based organizational identities	N/A	Theoretical
Baum and Rao (2004)	Population dynamics	Synthesis	N/A	Theoretical
Hsu and Hannan (2005)	Population dynamics	Identity	N/A	Theoretical
Romanelli and Fiol (2008)	Identity		N/A	Theoretical
Oertel and Walgenbach (2009)	Liability of smallness	Synthesis	N/A	Theoretical
Zimmerman and Zeitz (2002)	Organizational growth	Institutional perspective	N/A	Theoretical

Table IX.
Studies with a research focus on varied key constructs (identity, demography, population dynamics, growth) (1996-2010)

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Corresponding author

Manjula S. Salimath can be contacted at: Manjula.Salimath@unt.edu