An Annotated Bibliography of Organization Theory and Decision Theory Literature Related to Investigating the Influence of Development Stage in University Technology Transfer Outcomes and the Implications for Public Policy

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Introduction

This annotated bibliography summarizes literature related to a proposed study of the influence of development stage in university technology transfer outcomes. The preliminary research question to be examined is whether development stage helps to explain why private sector companies choose not to pursue university-created technologies that seem to align with their missions and profit motives even when the companies appear to have the resources to do so.

I intend to apply three major perspectives to investigate this research question. The first perspective is public sector economics to understand why government involvement and intervention is appropriate and necessary in the market for university-created technology. The second perspective is organization theory and behavior (organization studies) to understand how organizations function in the context of university technology transfer. The third perspective is descriptive decision theory to understand how organizations make decisions to acquire university-created technology.

I have already explored the literature through the lens of the perspective of public sector economics. I summarized these results in a separate annotated bibliography and literature review focused on this perspective. Those efforts specifically focused on literature related to (1) the definition of technology, (2) the definition of university technology transfer, (3) the role of the federal government in university technology transfer, and (4) determinants of success in university technology transfer. The current annotated bibliography focused on literature related to the second and third perspectives (i.e., organization studies and decision theory). It specifically focused on literature related to (1) methods for studying human behavior in the context of organizations, and (2) how decisions are made within organizations.

The reviewed literature included books published by reputable third-party publishers and peer-reviewed scholarly journal articles. I identified the initial group of materials included in this annotated bibliography through database searches of various relevant key terms such as “organization theory”, “decision theory”, and “descriptive decision theory.” I reviewed the bibliographies of that initial set of literature to identify additional related literature. I also included relevant literature identified during the completion of coursework for other classes in the Public and Social Policy (PSP) program at Saint Louis University.

Annotated Bibliography

Balogun, J., Pye, A., & Hodgkinson, G. P. (2008). Cognitively skilled organizational decision making: Making sense of deciding. In G. P. Hodgkinson & W. H. Starbuck (Eds.), *The Oxford handbook of organizational decision making* (pp. 234-249). New York, NY: Oxford University Press.

This book chapter essentially focuses on the process of decision making in organizations. As the authors noted, research on decision making has been dominated by simulations and lab-based experimental investigation from an information processing perspective. They point out that there is a socio-political dimension to decision making in organizations. As such, decision outcomes are a function of not only the quantity, accuracy, objectiveness, and timeliness of data but also social processes. Sensemaking and sensegiving are the social process with which the authors are most concerned as it relates to organizational decision making. Sensemaking is the process of constructing and reconstructing meaning through which a group of individuals collectively create, maintain, and interpret their shared social reality. Sensegiving is the process of trying to influence how others construct meaning towards one’s preferred meaning of social reality. Sensemaking and sensegiving underpin a power dynamic in organizational decision making and there is an interplay with the roles and identities of organization members involved. It may be the case that demand-side technology transfer professionals use development stage in sensemaking and sensegiving to influence the meaning of technology transfer opportunities.

Bengoa, A., Maseda, A., Iturralde, T., & Aparicio, G. (2020). A bibliometric review of the technology transfer literature. *The Journal of Technology Transfer*. doi:10.1007/s10961-019-09774-5

This journal article systematically examined the academic literature on technology transfer covering the period 1969 to 2018 using the Web of Science (WoS) Core Collection as the bibliographic database. This review was more comprehensive than previous bibliometric studies of technology transfer which tend to focus on specific areas of research interests, a more limited number of publications, or shorter periods of time. The authors identified five main streams of technology transfer research as university technology transfer, international technology transfer, intra-firm technology transfer, absorptive capacity, and innovation policies. The proposed dissertation study specifically focuses on university technology transfer. Within this research stream, the authors identified five sub-streams comprising academic entrepreneurship, new ventures, intellectual property, university-industry relationships, and technology transfer offices. The proposed dissertation study best aligns with the university-industry relationships sub-stream. The authors specifically noted that most research on this topic was from the perspective of universities and research institutions and not private sector organizations that acquire university-created technologies. The proposed dissertation study also seems to brush against the concept of absorptive capacity, which was defined as “a firm’s ability to recognize, assimilate, and apply external knowledge and learning processes” (p. 25). Research on absorptive capacity seems to fall within the discipline of organization studies. Most research in this stream has focused on understanding the factors that influence the absorptive capacity of a firm, when and how absorptive capacity can be a source of competitive advantage for a firm, and the relationship between absorptive capacity and firm performance. However, it appears that the research on absorptive capacity does not address why a firm chooses to assimilate and apply some technologies and not others. This suggests a clear gap in the literature that the proposed dissertation study can fill.

Cyert, R. M., & March, J. G. (1963). *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice-Hall.

This book details a behavioral theory of the firm that aims to merge economic theory with organization theory to address questions that the traditional theory of the firm cannot answer. The authors observed that the traditional theory of the firm is primarily a theory of markets and aims to explain how markets use pricing systems to allocate resources. It was never meant to explain how individual firms allocate resources internally, set prices, or establish output levels. The authors also note Milton Friedman’s argument that the goal of economic theory in general, which includes the traditional theory of the firm, is not to accurately reproduce economic phenomenon but to develop propositions that can be analyzed. The behavioral theory of the firm offered by the authors is meant to explain and predict the behavior of firms regarding decisions about price, output, and resource allocation. It explicitly emphasizes the actual process of decision making in an organization and takes the firm as the basic unit of analysis. The behavioral theory of the firm is comprised of three variable categories – organizational goals, organizational expectations, and organizational choice. Four major relational concepts – quasi resolution of conflict, uncertainty avoidance, problematic search, and organizational learning – connect the variable categories and act as fundamental mechanisms of firm behavior. Using these basic elements, one can build a variety of models to explain and predict firm behavior. The authors demonstrated the application of the theory by developing and testing four specific models. The model of rational managerial behavior and the model of trust investment trust behavior appear to be useful analogs for the proposed dissertation study. However, there is some question as to how much of the theory is applicable because it deals with organization decisions in the context of market conditions that are at least regularly recurring if not repetitive and routine. This likely does not characterize demand-side technology transfer decisions. The authors also provided a discussion of assumption, prediction, and explanation in economics in Appendix A of the book that delves into issues related to research methodology. It elucidated how to apply theory and provided some clarity about potential research designs for the proposed dissertation study.

Fisher, A. (2004). *The logic of real arguments* (Second ed.). New York, NY: Cambridge University Press.

Fisher details a method for understanding and evaluating natural language arguments that one might encounter in written texts and during academic study. Fisher explains how to identify and extract the elements of the argument and how to evaluate the soundness of the argument. The framework that Simon (1997) offers for understanding the decision-making process bears a striking resemblance to the structure of natural language arguments described by Fisher. As such, the approach and framework that Fisher provides seems to have application in understanding organization decision-making in general and in the context of university technology transfer, particularly with regard to categorizing decisions as “good” or “bad.”

Gertner, J. (2012). *The idea factory: Bell Labs and the great age of American innovation*. New York, NY: Penguin Press.

In a sense, this source can be considered a case study of converting basic research into private sector market offerings that benefit the public interest. It provides insight into the relationship between basic research, applied research, development, and manufacturing at Bell Telephone Laboratories. The account that Gertner offers provides additional evidence that challenges the conceptualization of a linear process from basic research that produces basic scientific insights to applied research that determine how to make practical use of such insights (p. 29, 150-151). The case of Bell Telephone Laboratories suggests that absolute freedom in basic research is counterproductive to generating research outcomes that benefit the public interest. Like food, freedom in basic research is healthy in moderation but unhealthy in excess (p. 194). Gertner references a paper that Bell Labs researcher Andrew Odlyzko wrote in 1995 that seems particularly relevant to understanding why private sector companies often do not pursue university-created technologies that seem relevant to their focus even when the companies appear to have the resources to do so. Odlyzko observed that it was no longer logical or necessary for private sector companies to invest in basic research for two key reasons. First, it took too long for private sector companies to realize an adequate financial return. Second, the base of scientific discoveries is so broad that it was now possible for a private sector company to generate sufficient profits by focusing on incremental improvements (p. 334). These two patterns seem consistent with a tendency of private sector companies to focus on later development stage technologies. Gertner also cites a 2008 study by Fred Block and Matthew Keller titled “Where do innovations come from?” which found that 77 of 88 U.S. organizations that produced innovations rated among the top 100 by *R&D* magazine in 2006 benefited federal funding (p. 332). These facts support the notion that development stage plays a significant role in technology transfer outcomes but they don’t provide definitive evidence and they don’t sufficiently explain the mechanism through which development stage may influence technology transfer outcomes.

Hatch, M. J. (1997). *Organization theory: Modern, symbolic and postmodern perspectives*. New York, NY: Oxford University Press.

This book provides a comprehensive overview of organizational studies. It uses the classical, modern, symbolic-interpretive, and postmodern perspectives to organize the subject. There is one chapter dedicated to organizational decision making including power and politics. It discusses the four major models of the organizational decision-making process based on the framework offered by James D. Thompson and Arthur Tuden (p. 276). Organizational theorists have observed and demonstrated that organizational decision-making only appears to approach anything resembling the rational model under highly restrictive conditions which suggest that the rational model is unlikely to apply in the context of technology transfer. There is also a contingency framework that models organizational decision-making as more dynamic with all four basic models occurring at the same time to varying degrees. The book briefly discusses Nils Brunsson’s notion of action rationality (pp. 280-281) which basically argues that action, not decisions, are the primary concern of organization members. Brunsson argued that putting organization decisions into the context of action essentially produces a paradox. A particular option can appear irrational when view from decision rationality but rational from the perspective of action rationality because of how they affect motivation and commitment which are necessary conditions for implementation. In the context of technology transfer, Brunsson’s theory would predict that there is a low rate of technology transfer from universities to private sector organizations because the private sector organizations apply decision rationality which decreases motivation and commitment to act on opportunities to acquire technologies created by research and development conduct at universities. The act of technology transfer can also be considered an act of organizational change and learning. This approach to examining the issue might also prove to be a fruitful line for future research in studying technology transfer.

Hatch, M. J. (2018). *Organization theory: Modern, symbolic and postmodern perspectives* (Fourth Ed.). New York, NY: Oxford University Press.

This is the fourth edition of Hatch (1997). The content of Part I and Part II are largely the same as the first edition but has been re-structured to provide additional clarity about the different perspectives applied to organization theory. This edition provides significantly more clarity about the postmodern approach to organizational studies than the first edition. A glossary has also been added. The difference between Part III of the two editions is extensive. Hatch (1997) identifies four major research themes in organization theory comprising organizational decision making, power, and politics; conflict and contradiction; control and ideology; and organizational change and learning. This edition of the book, Hatch has jettisoned this structure for Part III and now only discusses organizational politics, conflicts, and control as one broad meta-theme. Decision-making is discussed as an aspect of organizational politics taken up under theories coming out of the modern perspective. Hatch also discusses the concept of organization identity which prompted the thought that organization identity might interact with development stage in some way to influence whether an organization chooses to pursue the acquisition of a given technology.

Luhmann, N. (2018). *Organization and decision* (R. Barrett, Trans.; D. Baecker, Ed.). Cambridge, United Kingdom: Cambridge University Press.

Based on the premise that organizations are a significant and necessary part of modern society, Luhmann attempts to explain the “intrinsic logic” of organizations, which he conceives as processes. Luhmann makes this effort with the stated belief that a better understanding of how organizations function will produce more pragmatic public policy. He argues that scholarly research into the essence of organizations has become unproductive. Luhmann conceives of organizations as self-reproducing, self-maintaining, closed systems (autopoietic systems). However, Luhmann still seems to think of organizations life-like entities. His theory seems to focus on explaining how organizations determine what they can and should do given their relationship with their environments. But Luhmann’s approach to the topic seems unnecessarily difficult to understand. This in itself may be grounds to dismiss Luhmann’s framework as a potential organizing structure for the proposed study. He appears to criticize contemporary efforts to understand the organization as having supplanted the question of how organizations can avoid dehumanizing people with how organizations can best achieve their aims. However, the theory Luhmann offers seems to overlook the human aspect of organizations altogether. This makes Luhmann’s approach to organizations unappealing as a framework to guide an examination of the research questions put forward in the proposed dissertation study.

Mankins, J. C. (2009a). Technology readiness and risk assessments: A new approach. *Acta Astronautica, 65*(9-10), 1208-1215.

This journal article describes and approach to integrating the use of technology readiness levels (TRLs) with the concept of the risk matrix. The purpose of this approach is to address one of the shortcomings of the traditional TRL methodology. As explained by the author, the standard TRL scale does not address the question of how difficulty it will be to move from one TRL to the next. The author describes an approach that integrates the standard TRL scale with the research and development degree of difficulty (R&D3) scale and a proposed technology need value (TNV) scale. The R&D3 scale is a ratio scale that states the expected probability of success or failure of a research and development (R&D) project in achieving technology development objectives. The TNV is a ratio scale that serves as a weighting factor for the importance of a technology development effort. These measurements are used to plot a technology development effort on a matrix that has consequence of R&D failure on the x-axis and probability of R&D failure on the y-axis. This source highlights the challenge of effectively characterizing the development stage of a technology. The approach described is specifically tailored for government agencies that have technology-dependent missions such as the National Aeronautics and Space Administration (NASA) and the U.S. Department of Defense (DOD). It is probably very applicable to private sector organizations that act as contractors to those government agencies. However, there is a question of how well the approach generalizes to the broader set of private sector organizations operating in competitive markets.

Mankins, J. C. (2009b). Technology readiness assessments: A retrospective. *Acta Astronautica*, 65(9-10), 1216-1223. Retrieved from http://www.onethesis.com/wp-content/uploads/2016/11/1-s2.0-S0094576509002008-main.pdf

This journal article discusses the concept of technology readiness assessments (TRAs) as a means of characterizing the maturity of new technologies and summarizes the history of the technology readiness level (TRL) scale first developed and used by the National Aeronautics and Space Administration (NASA) and later adapted and adopted to varying degrees by other government agencies and private sector organizations. The author describes in some detail the TRL scale that NASA employs, which is an ordinal scale. According to the author, being able to assess readiness and risk at key points in the life cycle of a program is important to system and technology managers in government agencies such as NASA. The paper provides a normative discussion of how government agencies should use TRAs and TRLs. The author specifically suggests that funding at TRL-3 is unlikely to come from most types of funding sources available to private sector ventures because of the relatively high risk and long lead times required for projects at this stage of development. Moreover, he offers the opinion that funding at TRL-4 and greater could be obtained from funding sources available to private sector ventures because of reduced risk and lead times. However, anecdotal evidence suggests that this is not the case. This source is directly related to the proposed dissertation study. It provides relevant insight into the challenges of operationalizing and measuring development stage.

Mezias, J. M., & Starbuck, W. H. (2008). Decision making with inaccurate, unreliable data. In   
G. P. Hodgkinson & W. H. Starbuck (Eds.), *The Oxford handbook of organizational decision making* (pp. 76-96). New York, NY: Oxford University Press.

This book chapter discusses the effects of inaccurate and unreliable data on decision making in an organizational context. In establishing the importance of the topic, the authors note that a 2004 survey conducted by Waterhouse Coopers of over 200 business organizations in 30 countries across various industries found that more than 50 percent of the 10,640 identified projects failed and that business managers judged only 2.5 percent of the projects to have been completely successful. It’s reasonable to presume that these statistics would apply technology transfer projects as well. The authors argue that decision maker reliance on inaccurate and unreliable data are a key factor as to why so many business organizations have such high project failure rates. According to the authors, inaccurate and unreliable data are generated by inaccuracy of perceptions which is compounded by inaccurate predictions based on this perceptual data. The authors noted that research has shown that the perceptions of business managers about variables related to their areas of expertise are no more accurate that the perceptions of business managers with no expertise in those areas. The authors mentioned in passing the notion of uncertainty avoidance first proposed in 1963 by R. M. Cyert and J. G. March in *A Behavioral Theory of the Firm* and noted that few studies have examined how organizations go about avoiding uncertainty. They suggested that the concept of uncertainty avoidance is predominantly employed as a property of culture. The authors went on to argue that organizational members react to inaccuracy and unreliability in the decision-making process by seeking more data, ignoring contingencies when making predictions, reverting to ideology, creating after the fact justifications for decisions, and pursuing general, long-term goals in an incremental manner. These potential actions are all relevant to examining the potential influence of development stage on technology transfer outcomes and more than likely should be considered when developing the research design. In the context of technology transfer, organization members involved in evaluating an opportunity may use development stage as one way to pursue uncertainty avoidance.

Rojot, J. (2008). Culture and decision making. In G. P. Hodgkinson & W. H. Starbuck (Eds.), *The Oxford handbook of organizational decision making* (pp. 134-151). New York, NY: Oxford University Press.

This book chapter argues that the effect of culture on decision making is more usefully understood as a limitation on rationality. The author noted other researchers have postulated that in addition to organizational cultures, communities of occupations create occupational cultures that extend across organizations. These occupational cultures contribute to the similarities among organizations and influence the activities of organizations including the decisions of organization members. If this is true, then supply-side technology transfer professionals likely share an occupational culture that creates a limitation on rationality in technology transfer decisions that extends across private sector organizations. In the framework espoused by Simon (1997), this limitation may manifest as one or more decision premises related to development stage that are held among technology transfer professionals in various organizations. The author explains that culture-based limitations may be either beneficial or detrimental to the organization. Interestingly, the author referenced an observation of R. M. Cyert and J. G. March in *A Behavioral Theory of the Firm* that organizations do not have goals or make decisions, only individuals do. This is almost postmodern in its sentiment and very much aligned with my personal thoughts about how to apply organization theory to the examination of the proposed dissertation study.

Shapira, Z. (2008). On the implications of behavioral decision theory for managerial decision making: Contributions and challenges. In G. P. Hodgkinson & W. H. Starbuck (Eds.), *The Oxford handbook of organizational decision making* (pp. 287-304). New York, NY: Oxford University Press.

This book chapter provides a concise but thorough overview and comparison of the literature on behavioral decision theory and organizational decision making. The author argues that that are more differences than similarities between the research agendas of the two despite their common roots. According to the author, the major goal of behavioral decision theory is developing descriptive theories of decision making that can be compared with normative theories to generate prescriptive actions for improving decision making. Thus, the research of this discipline tends to focus on judgement, choice, and decision has primarily relied on laboratory experiments. The author notes that behavior decision theory research has yielded several significant contributions including the satisficing principle, prospect theory, and heuristics for availability, representativeness, anchoring, and adjustment. Organizational decision making poses several challenges for the researchers who study it. As the author explained, decision making in organizational context is longitudinal in nature, often repetitious, subject to pervasive ambiguity, and intertwined with incentives and conflict – none of which is factored into studies underpinning behavior decision theory. Researchers have primarily used field studies to examine decision making in organizations. Researchers who study organizational decision making often argue that behavioral decision theory research cannot be generalized to organizational decision making. However, the author argued that many of the findings of behavioral decision theory are robust and can be combined with aspects of organizational decision making to produce frameworks with greater explanatory power. The author offered studies on prediction and planning in construction engineering organizations and by entrepreneurs as examples. This source provides insight that is relevant to developing the research design for the proposed dissertation study.

Sigurdson, K., Sá, C. M., & Kretz, A. (2015). Looking under the street light: Limitations of mainstream technology transfer indicators. *Science & Public Policy (SPP), 42*(5), 632-645. doi:10.1093/scipol/scu080

This article examines the use of technology transfer indicators developed and published by the Association of University Technology Managers (AUTM) in policymaking. The authors specifically study the case of policymaking in Canada, but its findings are relevant to policymaking in the United States. They argue that the indicators reported by AUTM, which is a U.S.-based professional association, have essentially achieved *de facto* monopoly status when it comes to the data and information that policymakers use to formulate public policy on technology transfer. Overreliance on the AUTM indicators tends to overstimulate certain activities such as patenting and licensing while dampening other valuable technology transfer activities. These indicators affect all aspects of the policy process by influencing beliefs, perceptions, issue framing, problem analysis, and selection of possible solution sets. The AUTM indicators are widely used in Canada and the U.S. but they have several weaknesses. AUTM gathers the data from an annual survey of Canadian and U.S. universities that provides incomplete coverage of the institutions. Participation in the survey is inconsistent. The survey collects voluntary self-reported data that is not independently verified or validated. Reliance on the AUTM data requires assuming the respondents are accurately reporting unbiased data consistently among institutions. Given that university technology transfer offices are historically under-resourced, it is unlikely that this assumption is even remotely true. Additionally, the AUTM data only report indicators of formal technology transfer activity. However, research suggests that university technology transfer offices are involved in as little as one-third of university technologies that are commercialized. This source highlights the need for alternative approaches to studying and understanding university technology transfer to better inform policymaking. It suggests that the proposed dissertation study helps to fill a significant gap in the knowledge base that informs public policy regarding technology transfer.

Simon, H. A. (1997). *Administrative behavior: A study of decision-making processes in administrative organizations* (4th ed). New York, NY: The Free Press.

This book provides a useful scaffold for structuring a study of the role of development stage in university technology transfer. It provides a framework for using decision making as the basis for understanding the choices made and actions taken by individuals on behalf of the organizations to which they are members. Chapters 4, 6, 8, and 10 focus on the sociology of administration – what one might call descriptive administration theory. Chapters 3, 9, and 11 emphasize what Simon calls the practical science of administration – what might be aptly labeled as normative administration theory (pp. 356-360). Simon argued that decision making is the primary activity of organizations. Every physical action undertaken on behalf of the organization involves both “deciding” and “doing” (p. 1). For each action, there are a multitude of antecedent decisions that must occur to enable the final decision governing the action. Simon believed that the study of organizations must focus on the operative employee and the way their decisions and actions are influenced by the organizational context because the physical tasks of executing an organization’s intentions fall to operative persons who generally occupy the lowest level of the organization hierarchy (p. 2). As with physical tasks, there is specialization regarding decision making in organizations. Simon argued that two general kinds of decisions are made in organizations (p. 4). Value judgements are decisions geared toward the selection of final goals for the organization. Factual judgements are decisions involved in the implementation and achievement of final goals. Antecedent decisions are based on numerous facts (verified and presumed) as well as values, conditions, and constraints, which as a collective Simon called the premises of the final decision governing an action – that is, the decision premises (p. 23). Simon conceived of organizational decision making as a “decision-fabricating process” that involved fact-finding, intuition, guessing, analysis, reasoning, design, and negotiation (p. 24). In this production analogy, decision premises originate in various parts of the organization and are assembled into a final decision. Vertical decision making refers to the division of decision making responsibilities between operative and supervisory personnel within the organization (p. 23). Also relevant is Simon’s critique of role theory and the idea that roles determine behavior, which he argues is too constraining in its original connotation of a part in an organizational drama. Simon counters that a role specifies some, but not all, of the premises that underlie a decision (pp. 24-25). In effect, a role is simply a bundle of decision premises. Simon also detail what he called an experiment but is more aptly described as a simulation because it lacked a control, a stimulus, and random assignment (p. 298-302). Such as it is, the simulation provides a template for a possible research design for the proposed dissertation study that is worthy of consideration. With some modification, it could be turned into a true experiment that might provide significant explanatory power.