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To the NBER Productivity, Innovation and Entrepreneurship (PIE) Program

**Areas Applying To:** Innovation Policy, Entrepreneurship and Digitization

I'm writing to apply to the NBER post-doctoral fellowships for the year 2016-17. I'm a PhD Candidate at the MIT Sloan School of Management in the Technological Innovation, Entrepreneurship and Strategic Management (TIES) Program.

### **Introduction : Digital Mapping and Innovation**

In my research, I focus on the antecedents and consequences of knowledge production in digital markets as it relates to innovation, entrepreneurship and technology strategy. Broadly, my research investigates the ongoing digitization of knowledge production. While knowledge is a central component of the modern organization, the ways in which knowledge is produced, consumed and shared has been completely transformed by digital technology. This shift has fundamentally changed the ability of firms to produce new and different kinds of knowledge, and has increased the potential for new innovations to diffuse and impact economic outcomes. Despite these changes, we understand little about the implications of the digitization of knowledge for innovation and entrepreneurship. Through my research I hope to make progress on this important, yet poorly understood topic.

In my dissertation, I focus on the “digitization of geography”, the ongoing transformation of physical space into a digital object, and argue that this process is fundamentally reshaping how organizations understand and act upon their environment. By studying large-scale projects that are remapping the surface of the earth through digital technology (like NASA Satellite maps or Google Maps), I show that knowledge from these projects is having important implications for innovation and entrepreneurship in industries like natural resources exploration and digital navigation. From my dissertation is emerging a “mapping” approach to knowledge production that provides empirical and conceptual tools for future research. The basic idea is that the process of digitization does not simply transform knowledge from analog to digital media, but choices made about *how* knowledge is digitized introduces a new level of variation which influences follow-on innovation, entrepreneurship and firm productivity.

## Current Research

My current body of work includes three completed papers, two papers in the writing stage and two more projects that are currently underway. This section provides more details on two of these projects.

### **1. The Private Impact of Public Maps— Landsat Satellite Imagery and Gold Exploration** (*job market paper*)

This paper analyzes the introduction of new, satellite maps of the surface of the earth, and shows that quasi-random differences in map quality have had significant effects on the discovery of new deposits and entrepreneurship in the gold exploration industry. I study the NASA “Landsat” satellite mapping project, launched in the early 1970s, which provided new images that helped highlight unknown features of the surface of the earth, and guide the discovery of new deposits for firms involved in the gold exploration industry. While the mapping program was aimed at providing a comprehensive survey of the Earth’s surface, technical failures and the presence of clouds in images meant that some regions were mapped extensively by the Landsat program, while other regions were not. The paper finds that these differences matter at the industry level—firms are twice as likely to report new discoveries in mapped regions as compared to unmapped regions, and startups benefit disproportionately from the program as compared to incumbents. Further, the impact of satellite maps on encouraging discovery and startup performance is concentrated in regions with favorable financial and political policies, suggesting a complementary relationship between new technology and institutions supporting entrepreneurship. This paper highlights the underappreciated but possibly important role that new mapping projects could play in shaping the discovery of new opportunities across industries and firms. These findings have implications for related but separate literatures on technological change, innovation and the role of institutions on entrepreneurship.

### **2. Does Copyright Affect Reuse? Evidence from the Google Books Digitization Project** *R&R Management Science*

In this paper, I study the role of intellectual property on the diffusion of digitized information to Wikipedia. I find that while the digitization event increases the probability that information will be diffused to Wikipedia, copyright law shapes this diffusion in important ways. To precisely identify the role of copyright, I rely on a feature of copyright law under which issues of a single publication lapsed into the public domain if they were published before 1964, and remained in copyright if they were published after. By comparing the reuse of in-copyright and out-of-copyright issues before and after the digitization event, I am able to estimate the effects of IP on diffusion in this setting. I find that pages affected by copyright are less likely to contain information sourced from Google Books, and this reduction in diffusion due to copyright seems to depress internet traffic to affected pages. The effects of copyright also seem to be concentrated for non-textual media and for pages that have low and medium levels of popularity. The main contribution of the paper is to carefully identify the aggregate and distributional impacts of

copyright law on the diffusion of digital information in one important context.

### **Future Research**

In my dissertation, I have pursued the idea of digital knowledge production in the context of the “digitization of geography”, to understand the processes through which information about geography affects innovative outcomes. I hope to build upon my existing work and investigate other contexts where the “mapping” perspective can be applied to understand digital knowledge production.

In future work, I’m interested in the role of the government, in particular the US census in influencing economic outcomes. Data from the US census are used widely to understand demographic patterns and economic activity in the United States. However, some qualitative work indicates that as the census has digitized and introduced novel measurement tools and technology, their ability to update and measure demographic trends accurately has changed considerably. In my next project, I’m interested in understanding the history of digitization efforts of the US Census to identify important shifts in their mapping process, and also identify specific economic contexts where the impact of the Census digitization efforts could be measured and quantified. Through this work I’m hoping to inform a number of important questions like (a) what is the impact of the digitization of the US census on innovation and productivity?, (b) what are the costs and benefits of new information, and what should “optimal” mapping look like in the context of the US census and (c) is the digitization effort broadly beneficial for the private sector on average or does it introduce new distortions for industry participants that could be important for policy-makers going forward?

I’m hoping that both theoretical contributions and the empirical framework that I have developed in my dissertation will be helpful as I make progress on this project. Overall, I’m hopeful that both my novel empirical and methodological perspective, and theoretical ideas will have a broad impact on research in innovation, entrepreneurship and digitization.

Thank you.

Sincerely,

*Abhishek Nagaraj*