
The rise and fall of a micro-learning region: Mexican immigrants and construction in center-south Philadelphia

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Abstract. This paper documents the rise and fall of a micro-learning region in Philadelphia. The central actors in this region are undocumented Mexican immigrants who until recently were able to draw on the intensity of their workplace interactions and their heterodox knowledge to produce new and innovative building techniques in the city's residential construction. The new knowledge they developed was primarily tacit. More significantly, the learning practices through which immigrant workers developed skills and innovated new techniques were also heavily tacit. Because these practices were never made formal and were never made explicit, they remained invisible and difficult to defend. With the housing-market collapse and subsequent decline in housing renovation in the south-center region of Philadelphia, this tacit knowledge, and the practices that gave it shape and significance, are no longer easily accessible. We draw on this case to demonstrate the importance of access to the political and economic resources to turn learning practices into visible structured institutions that protect knowledge and skill. Whether or not the practices that support knowledge development are themselves made explicit can determine whether the knowledge they produce becomes an innovation that is recognized and adopted or whether it remains confined to a set of ephemeral practices that exist only so long as they are being enacted.

1 Introduction

If you had taken a walk through the residential neighborhoods a few blocks south of Center City Philadelphia in the fall of 2005, you would have seen a bustle of construction activity. Every third house would have been girded with scaffolding, and the whine of electric drills, the percussion of hammers, and the crack of masonry being stacked would have overwhelmed the everyday sounds of the city. You might also have heard Spanish being spoken, and noticed that many of the workers doing the construction work on the turn-of-the-century row homes ubiquitous in south Philadelphia were Mexican immigrants. What you might not have observed were the new hybrid building techniques being developed in the neighborhood, as Mexican workers blended the construction styles they had learned in their communities of origin with the building methods and materials they used in the United States. Even more difficult to see would have been the new learning practices emerging among immigrant workers, and the new construction skills that those practices produced. But even if you were not able to observe the innovation in construction processes being incubated around you, you would have observed a neighborhood literally being rebuilt.

If you retraced your footsteps in the fall of 2008, you would have been struck by the silence. Every third house would have had a 'for sale' sign in the window, and what little construction activity remained would have been winding down—a reflection

of the housing crisis that arrived in early 2007. Though you might still have seen Mexican immigrants in the neighborhood, chances are good that they would have been on their way to one of the few homes still being renovated to see if they could pick up a few hours of work. What you would likely not have noticed was that the new construction techniques, along with the practices through which they were developed, would have evaporated along with the steady work and solid incomes that had drawn Mexican immigrants to Philadelphia. When the hammers and drills fell silent, innovation also stopped.

We argue that, for a brief time, the thirty blocks just south of Philadelphia's Center City constituted a micro-learning region. Considering this neighborhood as a learning region reveals the extent to which marginalized immigrant workers, laboring under contingent arrangements, were able to author learning practices and produce new construction techniques. Immigrants turned the neighborhood in which they worked into one that fits easily within the broad characterization of a learning region, as defined through the rich literature on the spatial agglomeration of innovation (Gertler, 2004; Maskell and Malmberg, 1999; Piore and Sabel, 1984; Saxenian, 1994). Although construction in the neighborhood was basic, Mexican immigrants used it to bring heterodox ideas into contact and blend them into new approaches for residential construction. For the most part, immigrants worked in small teams, and the social interaction at the worksite was intensive enough to promote the development and sharing of new knowledge that was tacit in nature. An open labor market, shaped by social networks among immigrants, provided immigrant workers with easy access to jobs and allowed them to circulate among employers and construction sites that were clustered together within comfortable walking distance. As immigrants moved from worksite to worksite, they brought the new knowledge they had acquired or developed at their previous jobs to their new tasks. At the worksite, immigrant crews enjoyed enough autonomy to experiment with new building practices, and perfect them before they were subjected to employer scrutiny. Thus, the on-going production and circulation of tacit knowledge that immigrant practices allowed soon turned this thirty-block area of Philadelphia into more than a gentrifying neighborhood: they turned it into an innovative micro-learning region.

Considering center-south Philadelphia as a learning region also reveals how tenuous even the most generative of innovation clusters can be. The housing crash that brought the renovation of houses in center-south Philadelphia to a halt in 2007 made clear just how fragile it was, and how vulnerable the practices that fostered it really were. When the overheated gentrification of row homes in the neighborhood came to an end, the Mexican workers who developed new construction techniques found themselves abruptly out of work. Without construction sites to enact their learning practices or the hybrid construction techniques they produced, they were unable to protect either. More significantly, they had little access to the resources to make their learning practices and innovations visible to employers beyond the small neighborhood in which they had worked. Unable to demonstrate their new knowledge, the Mexican workers' status in the construction labor markets that remained was as precarious as if they had never worked in construction at all.

Immigrant workers' difficulty in demonstrating and defending their new knowledge and learning practices highlights an understudied aspect of learning practices: the tacitness of practices that support knowledge development and the degree to which that quality makes them potentially vulnerable. In center-south Philadelphia, the learning practices that immigrants developed were never made formal or explicit. They were improvised and embedded in everyday social exchanges that were nowhere structured, codified, or made visible in an organizational structure. Indeed, they were taken for

granted by the very participants who authored them. In a sense, they were as tacit as that of the knowledge they helped create.

Mexican immigrants' predicament when housing renovation in center-south Philadelphia ground to a halt reveals the importance of having access to the political and economic resources to make learning practices explicit and to capture them in structured institutions that protect new knowledge and make tacit skill apparent. The extent to which the learning practices are themselves made explicit can determine whether the knowledge they produce becomes an innovation that is recognized and adopted in a broader industry context, or whether it remains confined to a set of ephemeral practices that exist only so long as they are being enacted.

With academic and policy debates centering on the impact of immigration on working conditions and downward pressure on native-born wages, little attention is devoted to the role less educated immigrants play in developing new forms of knowledge and with it industry innovations. The factors that limit their ability to make their new knowledge visible as innovations receive even less attention. Thus, our goal in this article is twofold. First, we aim to draw attention to the ways that immigrants considered low-skilled participate in new knowledge creation. While scholarship exists that shows how immigrants considered to be low skilled can and do mobilize to inform work practices and the conditions of their employment (Fantasia and Voss, 2004; Iskander, 2007; Milkman, 2006; Valenzuela, 2003), the studies that document their role in developing new knowledge is sparse. Second, our purpose is to show the degree to which the tacitness of learning practices heightens their need for explicit institutions to support and reward their innovative contribution.

Our case study of housing renovation in center-south Philadelphia draws on extensive qualitative research at the neighborhood level. Open-ended interviews were conducted with twenty-six Mexican immigrants working in housing renovation in South Philadelphia, each lasting up to three hours, with repeat interviews conducted with about half of this group. Shorter, semistructured interviews, lasting over an hour, were also conducted with an additional fifty-nine immigrant workers employed in construction. All interviews with Mexican immigrants were conducted in person and in Spanish. We connected with immigrants at community gathering places, like local Mexican restaurants, Spanish-language mass, the Mexican consulate, grocery stores, laundromats, and Mexican cultural events. We also received referrals from Mexican immigrants we had already interviewed, increasing the number of workers we spoke with through a snowball sampling method.⁽¹⁾ Discussion during these interviews centered on employment history, both in Mexico before migrating and in the US, and on skill development, with a particular focus on where and how different skills were acquired. We conducted an additional twenty-two interviews with Mexican immigrants who were not employed in construction at the time of the interview in order to understand both the employment alternatives available to Mexican immigrants and the factors which shaped their employment choices. We also conducted interviews with several employers who hired Mexican immigrants. Additionally, we interviewed institutional actors, ranging from city government officials to representatives from building trade union locals. We complemented our interviews with on-site observations of several construction sites in center-south Philadelphia to identify worksite practices and the ways they supported knowledge development.

Section 2 is a consideration of the tacit dimensions of knowledge and its implications for both the learning practices and the institutional structures that support the development of learning regions. Section 3 outlines the factors which created

⁽¹⁾ All translations of interviews conducted in Spanish were completed by the authors.

the conditions for the emergence of a micro-learning region in the center-south of Philadelphia. Section 4 provides an overview of the labor-market characteristics that enabled innovative learning practices to emerge. Section 5 details the three types of practices which Mexican immigrants working in housing renovation developed to support learning and innovation. Section 6 explores why immigrants were unable to make their tacit knowledge and learning practices explicit, and details their vulnerability in the wake of the collapse of housing renovation in center-south Philadelphia. We conclude by discussing the implications of this case for the design of institutional interventions to support and defend immigrant knowledge creation.

2 Tacit knowledge and institutions in learning regions

Although observers of learning regions have brought disparate concerns to their studies, ranging from a focus on global competitiveness to an emphasis on innovation processes, their analyses share a core definition of a learning region. At base, a learning region is a spatial concentration of economic activity that supports the accelerated development of new knowledge, manifested in new products or new ways of doing things. Arguably, the process of production always allows for the development of knowledge, but what sets a learning region apart is that the creation of new knowledge rivals the production of goods as the source of the area's competitive advantage. Thus, a learning region must foster intensive innovation to qualify for that label. However, it does not have to produce knowledge that is necessarily at the technological frontier. Instead, the main feature that sets learning regions apart is that local actors have developed a collective capacity for on-going learning and knowledge development that is heightened and sustained. This capacity depends on two attributes located at the intersection of tacit and explicit knowledge. First, it depends on practices that develop and renew a knowledge base that has deep tacit roots but that can be represented in ways that are explicit enough for it to be scrutinized. Second, it relies on institutions that support and protect the practices that allow tacit knowledge to be refashioned into new conceptual approaches for completing a given task and new products.

Tacit knowledge is defined as knowledge that cannot be fully articulated or made explicit. Analysts of learning regions have identified a deep repository of tacit knowledge as the factor that makes learning regions places that are especially generative of new ideas, practices, and products (Gertler, 2004; Leonard and Sensiper, 1998; Piore and Sabel, 1984). Despite the attention it has received, it remains as elusive as when Alfred Marshall noted in his 1927 description of metal working in Birmingham, that in certain places, the 'mysteries' of a trade were 'in the air' (quoted in Sabel, 2001). This is because tacit knowledge is difficult to separate out from everyday practices, social relationships, and belief systems in which it is embedded. In contrast to explicit aspects of knowledge that can be represented and transmitted through language or other artifacts in formal, systematic styles (Hildreth and Kimble, 2002), tacit knowledge defies easy expression (Polanyi, 1966; Sennett, 2008). It is 'know-how' that can be gained only through personal experience on the job, but that cannot be easily or fully explained to others, especially to those who do not share similar job experiences (Cook and Brown, 1999; Cook and Yannow, 1993; Gertler, 2004; Lave and Wenger, 1991).

Although often presented as opposites, tacit and explicit knowledge are deeply interconnected: indeed, as Polanyi points out, it is the tacit, embodied dimension of knowledge that allows us to fully interpret and understand explicit knowledge (Hildreth and Kimble, 2002; Polanyi, 1966). However, tacit knowledge also depends on explicit knowledge to be functional: explicit representations—a blueprint, a text, a set of written instructions, or a mathematical formula—act as tangible depictions of subtle, embodied, and contextual understanding that enable actors to communicate

about it, even allowing it to be moved beyond the immediate practices through which it enacted and developed (Sennett, 2008). Explicit articulations of tacit knowledge allow it to be valued and appropriated (Bechky, 2003; Moodysson, 2008). Without this, tacit knowledge can be ephemeral and, thus, hard to defend.

As scholars of innovation have shown, practices that drive the generation of new ideas and new practices are those that explore the interplay between tacit and explicit knowledge. Learning practices create new knowledge in an on-going way by deepening the tacit knowledge base on which they draw (Collins, 2007; Nonaka and Takeuchi, 1995), while at the same time sharpening the explicit expressions of skillful practice (Nonaka and von Krogh, 2009; Sabel, 2001). But just like the knowledge they produce, learning practices also have a significant tacit component. Exactly how they produce new ideas, new ways of doing things, or new products, may itself be difficult to articulate or represent (Orlikowski, 2002; Schön, 1983).

Because the precise mechanisms through which learning practices generate new knowledge may be impossible to explicate fully, scholarly attention has turned to the main attributes that define them. Chief among these has been the intensity of social interaction characteristic of learning practices that allow actors to reshape knowledge in creative ways. Only by sharing in the social exchanges through which knowledge is communicated (Bechky, 2003; Gertler, 2004) and by joining in the face-to-face interaction that supports the exploration of the relationship between tacit and explicit knowledge (Storper and Venables, 2004), can actors in a learning region acquire enough familiarity with a concept or a technique to reinvent or improve it. So central are these social exchanges to innovation in learning regions that analysts have argued that local knowledge development is actually driven by a process of 'learning-by-interacting' (Lundvall and Johnson, 1994). In fact, some have argued that it is more accurate to say that knowledge produced in learning regions is held in the interactions *between* individuals and *between* firms, rather than *within* individuals or firms (Bathelt et al, 2004).

The spatial clustering of learning practices is a related attribute that the literature on learning regions has emphasized (Malmberg, 1997; Storper and Venables, 2004). The argument is that spatial proximity gives firms and individuals in learning regions greater access to interactions with multiple actors, across different settings and with reference to diverse production problems (Sabel, 2001; Saxenian, 1994; Storper, 1995). More critical assessments have countered that spatial agglomeration in learning regions is actually a reflection of economic activities that have little to do with innovation per se, such as the dominance of an industry or a firm in—or rather *over*—a specific locality (Christopherson and Clark, 2007a; Hudson, 1999). However, even these concede that the presence of leading firms requires the tacit knowledge that is embodied in the local workforce—knowledge which firms essentially purchase from workers when they employ them (Hudson, 1999).

An alternative approach has been to focus less on the social embeddedness of learning practices themselves and more on the institutional structures that support these practices in certain regions. Institutions are more established, routinized social practices, generally expressed as rules or organizations (North, 1990), that provide learning practices with an organizational container that can hold and protect contingent and sometimes ephemeral social exchanges through which the development of tacit skills happens. This institutional 'turn', in what Christopherson and Clark call "the move to make the learning region 'real'" (2007a, page 124), has scrutinized which institutions are critical for the development and renewal of learning practices in a given locality, and why. The focus on the learning regions scholarship has been trained primarily on more structured institutions like universities, training organizations,

financial providers like banks and venture capital outfits, government agencies and regulations, and labor-market intermediaries. Critical analyses of the role of such structured institutions have examined how they foster learning practices, and have called into question the presumed synergy between learning practices and institutions in learning regions, suggesting that the notion that institutions in learning regions are always supportive of all knowledge development may be too facile a representation (Gertler, 2004; Moodysson and Jonsson, 2007).

Moreover, the renewed focus on institutions in learning regions has raised questions about the power dynamics that those institutions reflect. In essence, it has opened the space for questions about who shapes the institutions which support learning practices in a given locality and whose economic priorities they reflect. Critiques of the learning region literature have disproved the notion that the innovation processes in given localities are somehow *sui generis*, and have cautioned that the emphasis on 'regions' has led to the reductive notion that regions as a whole, rather than the actors who populate them, enact policies or establish institutions to support knowledge creation (Christopherson and Clark, 2007a). These accounts have called for greater attention to the differing degrees of power and access with which actors in learning regions are endowed, and to the process of building institutions for knowledge creation as a highly political one, in which some actors can and do structure local institutions to their advantage, while others cannot (Glasmeier and Farrigan, 2007; Morgan, 1997; Peck and Theodore, 1998).

The position of labor is depicted as especially contested in this process of institution building, with lead firms, certain government agencies, and universities having greater sway than workers in determining institutional structure. These critiques have displaced early representations of learning regions as areas characterized by collaborative relationships that create possibilities for increasingly equalitarian and progressive forms of development (Florida, 1995) and show instead that labor is constrained and managed (Benner, 2003; Hum, 2003; Peck and Theodore, 2001), with workers often inserted into innovation and production processes over which they may have very little control (Carnoy et al, 1997; Christopherson and Clark, 2007b; Hudson, 1999; Markusen, 2007). Indeed, the only workers viewed as having the power to shape institutions that foster innovation are those considered to be critical to the process of innovation itself (Saxenian and Sabel, 2008). In other words, workers with the access and with the power to structure institutions are the only ones able to make their contribution to new knowledge visible; they are the only ones who can show how their particular tacit embodied knowledge is indispensable to the development of new explicit knowledge. So what then of workers, such as Mexican immigrants in Philadelphia, who author learning practices but do not have the power to shape institutions that support them?

Ironically, it is the tacitness of knowledge produced in learning regions—the very quality that arguably makes that knowledge generative of innovations (Collins, 2007; Gertler, 2004; Sabel, 2001)—that makes the power relations that influence the connection between learning practices and institutions so hard to challenge, and makes the resilience of learning practices dependent on the political access of those who enact them.

Because tacit aspects of learning practices make them contingent on their expression through practice (Lave and Wenger, 1991), they are extremely vulnerable to moments of economic, organizational, or political stress that may change or extinguish those practices. They risk being lost when the work processes through which they are expressed stop or when the people who perform them leave. Only if the tacit aspects of

learning practices are made explicit through formal and explicit institutions can they survive a pause in practice and be a resource for a new generation of actors.

The construction industry provides support for this. Construction skills, in general, are heavily tacit, context specific, and embodied, and are held and reproduced in the practices of building (Paap, 2006; Sebestyén, 1998). Still, as building trade unions have shown, that does not mean that they cannot be represented through explicit institutional structures. Although the process by which tacit knowledge is transferred is itself highly tacit and difficult to codify in a step-by-step manner, building trade unions have created explicit procedures to support and shield tacit skill acquisition (Palladino, 2005). Through apprenticeship programs, for example, they have created formal institutions to protect informal, social, and interactive practices required in construction knowledge development (Erlich and Grabelsky, 2005). Union training programs were hard fought and resulted in craft specializations and skill jurisdictions that helped protect and reward knowledge development (Palladino, 2005). Still, the ability of construction workers to benefit from these supports is dependent on their access to these institutions. Immigrant workers in Philadelphia, as a result of their exclusion from these institutional structures, have little access to the means to make the new construction knowledge they develop and the learning practices out of which it grows explicit. The practices remain contingent, present so long as they were enacted, but never protected in an institutional structure. The next sections detail the emergence and the disappearance of a learning region in center-south Philadelphia that immigrant construction workers helped to create.

3 The emergence of a micro-learning region

In the mid-1990s Philadelphia city government began a downtown redevelopment initiative that helped to reverse years of urban decline. It sponsored several large-scale public–private projects, such as the Kimmel Center for Performing Arts and the National Constitution Center, raising US\$1.3 billion of combined private–public funding for those projects. At the same time, the city encouraged residential development through the implementation of a ten-year tax abatement for converted residential properties in 1997. In 2000 this abatement was expanded to include new residential construction. By 2005, these policies abated over \$12 million in taxes. Emphasis on residential development, combined with increased attention to physical streetscape as well as large-scale commercial construction, promoted the development of the Center City area, attracting new demographics of residents and creating new, emerging sectors of employment (Kostelni, 2005; Kromer and Tam, 2005).

The city's efforts to revitalize its downtown showed dramatic results. The population of Center City, an area bordered by Vine Street to the north, South Street to the South, and the Delaware and Schuylkill rivers to the east and west, grew by 14% between 2000 to 2008, to more than 90 000 inhabitants, even as the rest of the city was shrinking (Adams et al, 2008, pages 26–28). Since 1997, over ten thousand housing units have been added to the area, with the average housing price within the core area of Center City increasing by 246% (Center City District and Central Philadelphia Development Corporation, 2008a). The housing in downtown was geared toward young, college-educated professionals, and soon their arrival made Center City the third largest downtown residential area in the United States, after Manhattan and Chicago (Adams et al, 2008).

As housing prices in Center City rose, the population growth began spreading into the residential areas just south of downtown. The neighborhoods adjacent to Center City were densely packed with row homes which became increasingly attractive to residents priced out of the Center City market. The availability of cheap and easy

credit throughout encouraged the purchase and rehabilitation of homes in the thirty block area south of South Street. The gentrification of the neighborhoods just south of Center City is evidenced by the rapid rise of home prices: median home sales prices rose by 207% between 1999 and 2006 (Board of Revision Taxes—Philadelphia, 2008).

The growth of the population downtown also supported the development of a thriving restaurant sector. From 1990 until 2006, the number of fine-dining establishments in Center City grew by almost 200%. By 2006, nearly 300 full-service restaurants were in operation in Center City proper, with an additional 200 just outside this central area (US Bureau, 1990; 2006).

The solid job prospects in the restaurant industry and in housing renovation were a major factor in attracting Mexican immigrants, first from New York where competition for employment was stiffer and, once a Mexican immigrant community was established in Philadelphia, directly from sending areas in Mexico such as Puebla, Oaxaca, Acapulco, and Mexico City. Official estimates show that the foreign-born Mexican population in Philadelphia proper nearly doubled, from 6200 in 2000 to close to 12 000 in 2006 (2000 Census, US Census Bureau, and American Community Survey, 2005–2007, US Census Bureau). Unofficial estimates from social service organizations place the number of Mexican immigrants significantly higher in 2006, at approximately 20 000. Although impossible to quantify accurately, there is wide consensus among observers of migration trends in Philadelphia, including social service providers, journalists, employers, and immigrants themselves, that the vast majority of Mexican immigrants to the city have been undocumented. For the most part, these newcomers have settled in South Philadelphia. Rent prices made affordable by the city's long decline in the 1980s and 1990s had initially made the rundown area attractive to new Mexican immigrants, and social networks between more established immigrants and new arrivals continued to accelerate settlement in the neighborhood.

The restaurant industry served as a 'gateway' industry for many Mexican immigrants. Restaurant work was often the first job for new Mexican arrivals to Philadelphia, with many immigrants having been recruited by friends or family members from their hometowns in Mexico specifically to take jobs in the industry (Kilpatrick, 2006). Housing renovation in center-south Philadelphia offered an employment alternative to this restaurant work.

Unlike other parts of the city where building trade unions dominated construction work, housing renovations in center-south Philadelphia were primarily nonunion, small in scale, and largely informal. Builders, who were either small contractors or professionals with day jobs as architects or engineers 'flipping' houses for profit, operated largely outside the regulatory framework of contractor licensing and building permits. This low-capital, small-scale residential sector required a flexible workforce that could easily adapt to the demand for various skills for relatively small tasks—for example, the need to do carpentry and framing, roofing work, or brickwork on a single house. The organization of residential construction in center-south Philadelphia, with its quick uptake and job completion and its lack of government regulation, opened up a growing labor market for immigrant workers and thus set the locational stage for the development of a micro-learning region in center-south Philadelphia housing construction.

4 Enabling factors: skills and labor-market practices

The skills immigrants brought to their jobs and the employment practices in the neighborhood created the organizational base that allowed immigrants to author the learning practices that would set the microregion apart. The majority of the Mexican immigrants working on housing rehabilitation in center-south Philadelphia came to the city with significant construction experience from Mexico. In fact, a full 60%

of the immigrants we interviewed had worked in construction before migrating, and an additional 10% had worked in related fields, like architecture or engineering.

Mexican immigrants' construction experience spanned a wide range, with some migrants having worked on large-scale commercial projects in Mexico City, others having worked on formal housing construction in cities and small towns, and still others having built their own, or their relatives', homes. As they labored on the housing projects, they compared the building materials, construction techniques, and tools they used in the United States with those they had used in Mexico. While working on housing construction in Philadelphia, they also acquired new skills, learning how to build using US construction materials, adopting US approaches toward measurement, and becoming adept at using a wide range of specialized tools. In the process, they brought Mexican and US construction styles together, and blended them in ways that allowed them to create new hybrid approaches that were not only innovative but represented a significant improvement in construction techniques for housing rehabilitation.

The organization of work on jobsites in the center-south Philadelphia and the nature of the relationship between employees and employers created opportunities for innovative learning practices to take hold. The hiring practices employers used to staff their projects were an initial enabling factor that supported on-going learning. As in other immigrant-heavy industries, employers tapped into the cosocial networks among immigrants to hire workers (Bailey and Waldinger, 1991; Cornelius, 1998; Milkman and Wong, 2000). Once contractors had hired the first one or two employees, often poaching them from the restaurants where they worked, they relied on them to hire workers to complete the small crew they needed to complete the housing renovation project. Teams were usually small, averaging three or four workers, but were relatively stable. Unlike the temporary employment of day laborers in construction, typically lasting an average of one to three days (Valenzuela, 2003), immigrant workers generally stayed on for the duration of a housing project, for periods ranging from several weeks to several months, and often, if the employer had multiple housing renovations running either consecutively or concurrently, remaining with their employer for longer periods.

As teams of Mexican immigrants worked together for several weeks at a stretch, they developed collective strategies to problem solve on the worksite. They marshaled the skills each brought to the team to tackle the tasks they were charged with that day. The teams used adjustable hierarchies: leadership was ceded to whoever had the most developed skills for the job at hand. As Pedro, an immigrant who arrived from Mexico City with basic construction experience, explained,

“if someone knows how to do something, he is boss that day. And you have to respect him for his skill, for what he knows. You have to watch and learn. If you show disrespect, people won't work with you ... I learned that the hard way.”

The stability of the teams allowed them to learn tacit skills from one another, and to experiment in a manner that was sustained enough for them to discover new techniques and new approaches.

Although the teams were stable, they were not permanent. Teams dissolved at the end of construction projects, and were reconfigured with new members at new sites. Occasionally, workers left and new members replaced them. Teams also expanded and contracted in response to the amount of work at a site. This flexible quality of teams at construction sites created a labor market in center-south Philadelphia that was open. It allowed workers to circulate easily through the multiple-job sites. Access to jobs on new sites was easy: not only was work plentiful, but the social networks developed through work on previous construction sites made finding a spot on a new crew relatively simple. Moreover, the worksites were all located in the same neighborhood,

within close walking distance. This spatial proximity allowed immigrants to identify potential employment options and investigate them as they walked through the area.

“If people know you are good worker, it not hard to find work. You can even just walk up to a house and ask ... Someone will know you or know someone who knows you ... Sometimes they know that you just finished working on the house up the street”,

explained Efrain of the labor market during the housing boom. This mobility afforded immigrants the opportunity to engage in work practices with different workers with diverse skills and experience. As in other learning regions, this team-based but high-velocity labor market contributed to the development of new knowledge (Saxenian, 1994): as workers moved through different worksites and joined new teams, they combined the mix of skills in each team in new ways to address the specific construction challenges that each home renovation represented.

“We work together to teach each other”,

added Efrain, who had worked as an electrician before migrating.

“If someone new joins [the worksite] and doesn’t know how to do something, we take the time to teach him, and make sure he knows how we do things here. That’s how we Latinos work.”

The learning practices that would emerge in center-south Philadelphia construction occurred primarily in spaces that escaped direct employer supervision and, arguably, because those spaces escaped employer control. At the jobsite, workers enjoyed considerable freedom to try out new approaches because their employers were, for the most part, absent. Small contractors or ‘flippers’ with day jobs as professionals, were literally not present at the jobsite during the day. A majority of workers we interviewed reported that their employers would arrive in the morning, give instructions and provide the tools and materials necessary for the tasks indicated, and then leave for the rest of the day, only occasionally returning in the afternoon to inspect the work completed.

“You know the boss is coming back at 3pm. He tells you what to do in the morning, and even if you don’t really know how to do it, I can tell you, you need to figure it out before he comes back. It’s like, one way or another, we have to finish, and we all work together to get it done in whatever way we know how to do it.”

Moreover, employers were also figuratively absent. Mexican workers, mostly new arrivals to the United States, had very limited English language ability and few of their employers spoke Spanish. The communication difficulties this produced opened up room for Mexican workers to experiment. Numerous workers recounted that they very often did not comprehend the directions their employers gave them. With a rough idea of the work their employer charged them with, they improvised with tools and materials to complete what they understood to be the task. As Ruben, a Mexican immigrant who had worked for the same employer for over a year explained,

“my employer doesn’t speak Spanish, and well, my English is not so great But my employer and me, we understand each other, more or less. When he comes in the morning, he explains what he wants done. I don’t understand everything he says, but he gestures and points, and I get the general idea. Anyway, me and my *compadres*, we figure it out. We have to! And at the end of the day, he is always happy with the work that we do. Well, almost always.”

5 Three learning practices

Combined, these workplace dynamics created opportunities for Mexican immigrants to experiment with new learning practices. The practices they developed to combine construction knowledge fit comfortably within the broad description of ‘learning by interacting’. Through repeated social exchanges, they shared information, compared

construction practices, and participated in joint problem solving. In turn, these social exchanges were grounded in the actual practice of construction. Practices of learning and innovation occurred through physical engagement with construction tools and materials, and were folded into the everyday tasks of building. Still, three kinds of ‘learning by interacting’ can be distinguished: adaptive experimentation, external observation, and tangible demonstration.

Adaptive experimentation was the exploration of how different forms of tacit building skill could be used to solve construction challenges on site. In center-south Philadelphia, it consisted essentially of applying Mexican construction techniques to the construction materials and construction styles prevalent in Philadelphia housing. Mexican workers, for example, used the deep tacit understanding of concrete many brought with them from Mexico to explore how different concrete mixtures fared for tasks as varied as repointing (repairing) damaged masonry, finishing basements, and weatherizing building exteriors. By touching the mortar, by using it in different contexts, by manipulating it with different tools, they investigated how mixtures needed to be amended to accommodate varied weather conditions, the passage of time in a day, and the materials to which they were being applied. Similarly, they developed a streamlined approach to leveling when framing internal walls and hanging sheetrock, bypassing some of the specialized—and unnecessary, according to workers we interviewed—tools used for leveling and measurement. They also explored the functionality of the comparatively wide array of tools used on US construction sites, trying them on materials and using them for tasks in ways that were different than those specified by their employers.

In addition to experimenting at jobsites, Mexican immigrant workers tried out different construction techniques in other contexts where their employers were absent. The most important of these were side projects they completed outside the scope of their employment relationships. Side projects consisted mostly of small repair and renovation work on private homes, either in center-south Philadelphia or in South Philadelphia where Mexican immigrants lived. All of this work was informal, paid for in cash, and small in scale, requiring only a few days of labor. Essentially self-employed for these side projects, Mexican immigrants reported being more daring in experimenting with new skills and techniques than on their jobsites.

“I wanted to learn how to lay tile, but my employer wouldn’t let me do it because he said I didn’t know how. But I knew I could figure it out. So I laid down tile in the home I am renting. It took me a while to get the hang of it, but it looked nice when I finished”,

recounted Abel. Memo and Lalo, two cousins who worked on housing renovation during the daytime and as a busboy and prep cook at a Center City restaurant during the evening, took side jobs during the periods of time when they could not find employment on a housing renovation projects. Memo explained that the side jobs enabled them to sharpen the skills they began to develop on larger construction sites.

“I watched to see how they fixed brick walls at a construction site that I worked at before, but Lalo and I really figured out how to do it when we repaired a brick walkway for a this lady on 22nd Street. It wasn’t perfect, but that’s when I started really understanding how to do work with brick.”

The second key practice for knowledge development in center-south Philadelphia learning region in construction was *external observation*. In any experimentation, observation is a central aspect in the practice of trying out new approaches, noting when they are effective and when they are not, and discerning how the techniques of coworkers differ (Raelin, 1997). That kind of observation was part and parcel of the everyday exchanges of workers on the construction project, and was critical to their

ability to continue with their experimentation and improvisation. In contrast, external observation specifically refers to construction knowledge that was acquired outside the team or dyad experimentation exchanges, yet was brought into the interaction among workers at the jobsite. Mexican workers called this type of external observation ‘stealing with your eyes’; their term for this practice conveys its subversive quality in a labor-market context that presumed Mexican workers to be unskilled, interchangeable, and cheap.

Mexican workers in Philadelphia housing construction used external observation to appropriate explicit articulations of knowledge, which they then explored to uncover the tacit component to which they referred. Blueprints and construction manuals were Mexican workers’ primary source of explicit representation of construction skills. Several reported poring over discarded blueprints in an effort to decipher how the work they had completed fit into the overall logic of the housing renovation.

“After work, after everyone left, I used to take blueprints out of the trash. I would take them home, flatten them out—they were all crumpled—and try and understand what I had done that day. That’s how I learned how to build reinforcement supports for these old buildings that are always leaning one way or another ... I would look at the measurements on the plan, and then the next day at the site, I would compare what we did to what I remembered from the drawing”, remembered Juan, who had done foundation work on his construction jobs in Mexico. Miguel reported a similar experience:

“I wanted to understand why the frames for drywall were built one way at one house and another way at another, why the beams were placed at different distances, so I started looking at the blueprints. My boss was cool. He never gave them to me outright, but if he caught me looking at them, he pretended he hadn’t seen me.”

Construction manuals and trade journals were another form of explicit knowledge that Mexican workers observed and imputed back to their work. Many of the employers in center-south Philadelphia who were not professional contractors relied on ‘how-to’ books to guide them through some of the more complex construction tasks. On site, where these manuals were used, immigrant workers report examining them at length and gleaning whatever information they could given the language barrier. Joaquin explained that he became a skilled marble worker by pouring over trade publications that his employer discarded. He used the schematics they provided to conceptualize more clearly the connection between practices and become more precise in his carving. His experience was shared by many others who also reported looking at the illustrations in trade publications to get a sense of the connection between tasks.

“I used to go to Home Depot sometimes and spend the afternoon looking at the [construction] magazines and visiting the tools I couldn’t afford”, said Efrain, who aspired to expand his side-project enterprise.

“It helped me see why vents go where they do, how to put insulation in, plumbing ... seeing them all together on the rack, well, I could start to see how things went together.”

In addition to appropriating explicit knowledge, Mexican immigrant workers also reported observing tacit skill and applying it to their construction practices. They watched the practices of highly skilled construction workers, largely nonimmigrant, to glean insights from their performance of tacit construction knowledge. For example, they observed skilled technicians who came onto the construction site to complete tasks where a licensed practitioner was required to sign off on the work: plumbers and electricians fit this category.

“For the first couple of houses we worked on, we just watched the electrician work. We were driving him crazy, looking over his shoulder the whole time, but

by the third house, we laid down the wires ourselves, and our boss brought in the electrician just to check our work and connect our wires to the [fuse] box”, said Rafael.

The third practice that contributed to knowledge development in center-south Philadelphia construction was *tangible demonstration*. Mexican immigrants used the materials they built with to make the tacit knowledge they had developed through experimentation and observation visible to themselves and others. The results they achieved in the building showed whether the hybrid construction techniques they were developing were effective, and they also pointed to the areas where the immigrants’ improvised approaches still needed to be polished. Drywall taping was an example cited in our interviews. Considered the ‘artistic’ part of hanging drywall, taping drywall joints is a process that typically involves several applications of drywall mortar compound—called ‘mud’—the skillful stretching of taping down the seam between drywall boards, and thorough sanding after the compound dries. Mexican immigrant workers reported drawing on their experience applying plaster to concrete walls in Mexico to reduce the number of ‘mud’ applications and to drop the sanding step. Applying the tape strip to the drywall joints, however, presented an intractable stumbling block to the development of this new technique. Laying the tape, a distinctly US task, required holding the plastering knife at a different angle with a different level of tension than in applying mud, a material analogous to plaster. “It requires a different touch”, said Francisco. “You have pull [the knife down] just so”, he added as he gestured to mimic the technique on an imaginary wall. Repeated cycles of experimentation yielded mixed results, but each iteration—each new joint—elucidated how they needed to modify their practice. When the joints using the method Mexican workers developed were indistinguishable or better than the joints that were ‘by-the-book’, the walls themselves became proof of the effectiveness of the new approach the workers had improvised.

Tangible demonstration was also a crucial way for immigrants to make their skill visible to their employers. Several workers cited mixing concrete as an example. They reported that their employers gave very specific instructions on how to mix concrete, and that the employers’ insistence on a particular recipe was an expression of the fact that they did not recognize Mexican immigrant skill. Only when employers observed the demonstrated results of Mexican approaches, and especially the savings in cement required, did employers recognize the aptitude of the Mexican employees in this area.

“My boss told me to mix the concrete a certain way. I knew I could do it better so I did it the way I wanted to When he saw the results, ... saw that I was saving him money, he agreed to let me do it my way”,

recounted Carlos. Mexican workers’ experience with concrete mixing was repeated with other materials. Abel, for example, swayed his boss who had refused to let him lay tile on the jobsite by bringing him to inspect the workmanship on the tile floor Abel had laid in the bathroom of his house.

“I told him, ‘come see, come touch it, run your hand across it and see how flat I got it’”, he recounted.

Each of the three types of practice identified—adaptive experimentation, external observation, and tangible demonstration—were central to knowledge development in center-south Philadelphia housing construction. Each allowed for the combination of different forms of construction knowledge, supported the deepening tacit skill, and fostered creative improvisation. In a recursive cycle, Mexican workers’ experimentation on the jobsite enables them to develop a skill base strong enough to absorb and integrate the knowledge that they gleaned through external observation, and the demonstration of new techniques enabled them to identify where they needed to use additional experimentation to refine emerging techniques further. As the workers

circulated among jobsites in the neighborhood, so too did the knowledge they acquired and developed. In the process, Mexican workers fed and drew on a shared knowledge base, one that supported the accelerated knowledge development that sets learning regions apart. However, neither these learning practices nor the innovations they produced were ever made explicit or captured in an organizational structure. They remained tacit and informal, confined to the neighborhood where they emerged.

6 The vulnerability of tacit knowledge and tacit learning practices

The hybrid building techniques that Mexican workers developed, combining Mexican and US construction styles, enabled them to better address the unique challenges that rehabilitating Philadelphia workingman's row homes presented. Unlike new construction which is built from the ground up and where all structures are built to measure, housing renovation requires working with existing structures, some of them sound, but others in need of special accommodation, if not outright repair. Moreover, structures and their interrelationship in old homes are not always easily visible: with Philadelphia's late-19th-century row homes having already gone through several renovations, it was not uncommon to find elements such as fireplaces and entryways behind newer walls, nor was it unusual to discover that bearing walls had been removed, such that other features, not designed to provide structural support, were holding up the house, sometimes along with the neighboring one.

Thus, housing renovation in Philadelphia row homes requires devising creative solutions on a daily basis to the constraints, visible and invisible, existing structures pose. In one example, the drywall techniques that immigrants elaborated enabled them to blend new drywall construction with existing finishes made of horsehair plaster, a historic building material. Moreover, the robust understanding of the relationship between tasks and materials they developed by working together on multiple tasks at different sites enabled them to participate in planning the sequencing of renovation steps. Additionally, as they moved from one task area to another, they were able to manipulate the materials in a manner that reflected the connection between tasks rather than their distinction. This ability proved especially helpful in houses that were being retrofitted to be 'green': incorporating elements such as new insulation materials, sealing walls, and installing green roofs depended on an understanding of how a given building task needed to be modified to allow for a following one.

Still these innovative construction methods were hard to fully demonstrate and defend in part because they were rarely visible in the final product. They were, in a sense, a better means to the same construction end. Moreover, they were nowhere captured in explicit representations, like drawings, verbal or written instructions that were fully articulated, or a set of clear guidelines for problem solving on site. Likewise, the specific learning practices through which Mexican workers honed new techniques—adaptive experimentation, external observation, and tangible demonstration—remained tacit because they were woven into the actual work of building. For immigrant workers and their employers, they were indistinguishable from everyday construction activities: they were simply part of getting the job done.

Avenues available to actors in other learning regions to make tacit knowledge and learning practices visible and durable were closed to Mexican immigrants in center-south Philadelphia. Chief among these is entrepreneurship. Establishing a business is a vehicle through which actors in learning regions can make their innovation explicit, and can formalize the practices that produced it into structured workplace routines (Bailey and Waldinger, 1991). Although many immigrants we interviewed expressed a desire to expand their side projects into a full-fledged construction business, the Pennsylvania law preventing undocumented immigrants from obtaining a driver's license

stymied these ambitions. Many immigrants had their crews, their tools, and access to a truck, but without a valid driver's license, could not easily transport construction materials to and from the worksite. They risked being stopped, being fined or having the vehicle they were driving impounded, and increasingly taken into custody and deported for violating immigration law.

Other possible avenues to make their knowledge and learning practices explicit were also unavailable. Mexican immigrants, as a result of being excluded from construction labor unions, had no ties to local training organizations with which they could share their new methods. Their undocumented legal status also meant nonunion certification programs were inaccessible, thus making it difficult to demonstrate and signal skill. At the same time, community organizations that offered social services to Mexican immigrants were not concerned with workplace skill. Finally, employers, even while expressing satisfaction with immigrants' labor and at times recognizing the value of their techniques, were primarily concerned with seeing their housing renovation completed and had little interest in supporting the further development of jobsite practices. Even if they had, these employers were marginal industry players, themselves lacking the local intraindustry ties necessary to begin a wider conversation about how to make explicit and formalize the practices of their immigrant workforce.

When construction work was abundant in center-south Philadelphia, the tacitness of the knowledge and of learning practices in the microregion posed little problem for job security or continued innovation. However, the conditions that had prevailed in the neighborhood would change dramatically with the housing-market collapse. Between 2007 and 2009 housing prices in Center City and adjoining neighborhoods dropped by 16%, and home sales dropped by half. While new residential and commercial construction projects were impacted by the economic downturn, activity in this sector of the industry still continued, albeit at a much reduced level. Housing renovation in center-south Philadelphia, however, had ground to a halt by 2009. In followup interviews in April 2009, the majority of Mexican construction workers reported that they had not worked for several months, and were not seeing the springtime seasonal uptick of work. Many were returning to the restaurants seeking jobs that were also becoming scarcer. Still others joined their spouses in home cleaning.

When construction jobs disappeared in center-south Philadelphia, so did the new knowledge and learning practices for innovation that had emerged in the neighborhood. As work opportunities shrank drastically, so too did the medium through which Mexican immigrants enacted their evolving but tacit construction skill. To be sure, individual workers still possessed some aspects of the abilities they had acquired through their work on construction sites. However, because that skill was tacit and thus difficult to fully articulate, it needed to be performed to become visible and defensible. No employment meant that they had no opportunity to enact this tacit skill. Furthermore, the learning practices they developed, the practices that turned the neighborhood into the micro-learning region, depended on interactions with other workers: their skill at completing particular construction tasks was bundled with the ability developed in the neighborhood to collaborate on a job, to problem solve collectively, and to learn from and thus teach one another. With no construction work, there was nowhere to experiment collaboratively with new techniques, and no building materials or tools to test out in the completion of varied tasks. Nor was there any tangible vehicle—no materials, no finished construction product—through which to demonstrate the tacit skill immigrants had elaborated.

For immigrants, the disappearance of the medium of work through which they demonstrated their tacit ability meant that their construction knowledge became invisible to new and prospective employers. With no explicit representation of their

abilities accessible to them, they were essentially considered unskilled workers in the labor market, despite their solid experience in a specialized area of construction. The de facto erasure of their skill made it impossible for them to break into remaining nonunion construction markets, dimming their economic prospects even further.

7 Resurrecting the learning region?

This paper documents the rise and fall of a micro-learning region. The central actors in this region are undocumented Mexican immigrants who until recently were able to draw on the intensity of their workplace interactions and their heterodox knowledge to produce new and innovative building techniques in Philadelphia's south-central construction industry. With the housing market collapse and subsequent decline in housing renovation in the south-center region, this tacit knowledge and the learning practices that gave it shape and significance have disappeared.

Not only did immigrant workers lose their ability to demonstrate their talent, but Philadelphia's construction industry also lost a potentially important knowledge base. Immigrants in south-center Philadelphia, through their daily practices, essentially developed a new kind of construction skill, one that centered on the transformation and upgrading of historic and dilapidated buildings. In this regard, this new knowledge and the practices that contributed to its development, should be viewed as a resource not just for immigrant workers but for the larger economy in which they are based. The practices that immigrants developed to improvise and problem solve using a variety of technical skills and drawing on a deep understanding of the relationship between multiple tasks could prove valuable for future construction work in this and other historic neighborhoods. They may also serve as an important resource for the environmental retrofitting of existing housing stock.

Yet for this opportunity to materialize, stronger and more explicit institutional supports are needed to help transfer, protect, and encourage immigrant knowledge development and in the process, create the necessary conditions for a more resilient micro-learning region to take root. That many immigrant workers with deep construction knowledge and experience continue to live and work in center-south Philadelphia creates the possibility for reuniting this talent and redirecting it to new pockets of construction activity in Philadelphia. However, it is unclear which formal institutions would and could step in to facilitate this process. Barriers that keep immigrants from formally institutionalizing their knowledge in small businesses, such as legal provisions that prevent undocumented immigrants from acquiring driver's licenses, continue to exist. Unions in Philadelphia, for their part, strongly oppose immigrant access to construction jobsites and use their industry status to create considerable employment barriers. Still other institutional actors, namely worker centers and community-based organizations, could step in to protect immigrants' learning processes and knowledge development. Whether these efforts would be sufficient to overcome legal barriers and resurrect south-central Philadelphia's micro-learning region remains an open question.

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