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University-led innovation in and for peripheral urban areas: new approaches in Naples, Italy and Newark, NJ, US

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\section*{ABSTRACT}
This paper focuses on the spatial development problem of university-led innovation in peripheral urban areas. Highlighting issues of proximity, uneven geographic development, and multi-scalar urban governance as weaknesses of the regional innovation systems literature, we provide a novel synthesis of regional economics, innovation policy, and critical urban studies to assess the development roles of universities in concrete contexts. A comparative investigation of Naples and Newark, NJ captures the functional operation of regional innovation and urban development as a contested product of discourses, technologies (material and governance), and territorial arrangements. Our analysis demonstrates the significance of multi-scalar relationships in structuring innovation policy and practice in peripheral urban areas. The architecture of innovation is not simply rolled out into pre-determined spatial containers in places lacking established ‘institutional thickness’ or urban centrality. The spatial development of university-led innovation is a social product: material and governance infrastructures are essential components of the urban fabric and are essential to its co-constitution. Universities are shown to contribute differing resources dependent on their institutional strategic goals and the capacities and spatial imaginaries afforded to them by their situation in broader territorial governance regimes. We conclude by drawing comparative lessons and identifying directions for future research.

\section*{Introduction}
San Giovanni a Teduccio, a downtrodden suburb of Naples, is a far cry from Silicon Valley. The crumbling apartment buildings, the walls covered in either graffiti or church death notices, and the ubiquitous clotheslines hung outside people’s windows do not leave the impression that the neighbourhood is a centre for high technology. And yet it is this spot – a corner of the sprawling city of Naples that never quite recovered after a major food-packing factory shut its doors in the 1980s – where the Apple chief executive, Tim Cook, and the Italian prime minister, Matteo Renzi, hoped the best and brightest young minds in the world will come to develop into leaders in the new app economy. (Kirchgaessner, 2016)
Community and business leaders in Newark, NJ recently took a big step toward transforming their city’s economy. A newly announced $50 million venture fund—capitalized by Audible.com and Prudential Financial and backed by city and state leaders—aims to support a cluster of tech firms in New Jersey’s largest city. Additionally, the partners announced a new start-up accelerator space in downtown Newark near Rutgers Business School and the Broad Street train station, as well as an outdoor municipal high-speed Wi-Fi network that will serve public spaces as well as housing authority properties in the downtown … investors would be wise to view Newark not just as a cheaper alternative to New York City, but also as a place rich in advanced industry assets. (Katz, 2015)

Naples and Newark, may seem strange bedfellows in debates over high-tech urban economies. The above narratives – regarding the establishment of the joint Apple-University of Naples Federico II ‘iOS Developer Academy’ and the launch of ‘Newark Venture Partners’ respectively – however, capture the endemic aspirational and disciplinary logics of innovation-led urban development now unfurling at a global scale. On one hand, a resurgent normative preference for creative inner-city economies and technologically-enabled ‘smart’ urbanism has reaffirmed cities as essential hubs for knowledge-based industries and employment. Symbiotic relationships between innovation and urbanization, often drawing on local university partners, can engender a virtuous cycle of economic development and urban revitalization (Etzkowitz, 2008). On the other hand, the prospects of missing out on a slice of the knowledge-economy pie has compelled policymakers to doggedly pursue instrumental knowledge-based development as a panacea for struggling post-industrial economies. While the urbanization of innovation presents a potentially progressive form of economic and territorial regeneration (Rossi, 2016), deep multi-scalar processes of uneven development belie simple accounts of innovation-led success. For peripheral and persistently-deprived urban areas (from neighbourhood to city-regional sub-centre scales), the absence of established innovation cultures and ‘institutional thickness’ present pervasive obstacles to their integration into a highly-competitive knowledge-based space economy (Pelkonen & Nieminen, 2016). There is a need, therefore, to examine how peripheral urban areas can be (re)connected to the social and material infrastructures of regional innovation (and the city more broadly) in meaningful ways.

In this paper, we focus on universities as actors, catalysts, and strategic settings capable of integrating peripheral urban areas into broader-scaled economic and spatial development agendas. As regional development and innovation policy have converged over the past decades (Schmidt, Muller, Ibert, & Brinks, 2017), academic and policy-oriented work has explored the role universities can, and should, play as privileged agents of territorial growth and anchors of innovation ecosystems (Lawton Smith, 2007). Questions surrounding peripheral areas have been subject to rigorous debate at the regional scale while analytical accounts have started to shift from thick descriptions of more or less innovative regions to questions of intentionality, agency, and governance (Benneworth, Pinheiro, & Karlsen, 2017). What is missing, though, is a precise understanding of, and sensitivity to, the multi-scalar nature of uneven geographic development surrounding innovation-led economic and territorial policy and practice. Innovation-led urban development not only reflects inter-regional disparities, but strong intra-regional and intra-urban inequalities. Here, the socio-spatial structures of urban space are not mere containers in which pre-given innovation processes and governance relations play out, but are essential constitutive dimensions of such systems.
Our aim is to situate debates on innovation policy and post-metropolitan urban transformations within the context of university-led spatial development. This research draws on novel cross-disciplinary insights from regional economics, innovation policy, and critical urban studies, and is operationalized through a relational urban comparison of peripheral areas within large urban agglomerations. The cases of Naples, Italy and Newark, NJ, USA reveal a variety of physical and social infrastructures being used to support university-led innovation for urban development. Initiatives currently being rolled-out in the case areas are actively constituted, negotiated, and reproduced through discursive, infrastructural, and territorial arrangements. Different universities are shown to contribute differing resources dependent on their institutional strategic goals and the capacities and spatial imaginaries afforded to them by their situation in broader territorial governance regimes. Results of this analysis may guide policymakers, researchers, and university managers to develop deep sustainable connections between cities, citizens, and research institutions in socially and spatially peripheral urban areas.

The argument is structured as follows: in the next section, we present an overview of the university and city in regional innovation systems approaches, identifying two significant issues in the context of peripheral urban areas: the problematic of proximity and the need to examine multi-scalar urban governance and uneven development. After outlining our conceptual framework, the paper presents a comparative account of university-led innovation as an urban development strategy in Naples and Newark. Drawing from semi-structured interviews with university and research centre managers, academics, and city officials between 2014 and 2017, in addition to participant observation and a discourse analysis of government and university materials, the study highlights the multifaceted, multi-scalar processes through which university-led innovation is enabled and embedded in place. We conclude by drawing comparative lessons and identifying directions for future research.

Universities, innovation, and urban-regional development

Regional innovation systems and the urban-academia nexus

Over the past three decades, varying schools of thought have attempted to theorize the function and impact of universities on urban and regional development (Tripl, Sinozic, & Lawton Smith, 2015; Uyarra, 2010). Within this milieu, ‘regional innovation systems’ (RIS) thinking has emerged as a preeminent conceptual paradigm, notably by theorizing universities as deeply implicated in the systemic architecture and practice of innovation. Although subject to debate and a degree of definitional ambiguity (Doloreux & Parto, 2005), RIS approaches emphasize ‘economic and social interaction between agents, spanning the public and private sectors to engender and diffuse innovation within regions embedded in wider national and global systems’ (Asheim, Lawton Smith, & Oughton, 2011, p. 878). Demand-side actors include national governance entities that regulate innovation practice, local and regional governments concerned with territorial economic development, and a myriad of public and private organizations concerned with high-tech entrepreneurship. Universities and research centres, in contrast, occupy privileged positions as supply-side actors (with varying degrees of efficacy) providing
knowledge and research competencies and generating new spin-off firms and commercializable outputs (Charles, 2006).

The regional functions ascribed to universities in RIS analysis do not depend on their own internal organization and orientation (as with the ‘entrepreneurial’, ‘Mode 2’, or ‘engaged’ university) but rather on contextually-specific relations with other actors and knowledge bases along path dependent growth trajectories (Trippl et al., 2015). Fritsch and Slavtchev (2007) suggest that the efficacy of universities in regional innovation is driven by the quality of research and intensity of interactions with firms, not the size of the institutions involved. This endogenous role is prominently captured in the non-linear, recursive linkages of ‘triple helix’ university-industry-government relations (Etzkowitz, 2008). Triple helix analyses draw attention to new behavioural trends in which individuals and organizations within helices can assume roles beyond those traditionally ascribed to them. Cross-institutional relationships promote the bundling of resources to support technology transfer, firm formation, and the development of capital intensive infrastructures. But they also have a transformative impact on the university itself; engendering the construction of hybridized structures to integrate teaching, research, and commercialization activities, and imbuing them with entrepreneurial imperatives (Audretsch, 2014).

Deepening interest in commercializing academic enterprise has fed into a policy paradigm whereby universities are expected to stimulate economic development via knowledge transfer to co-located industries (or catalysing new firm formation). With the implementation of policies pushing investment in innovation by academic and governmental institutions, universities’ direct actions (spin-offs, technology parks, etc.) and indirect impacts (increased network thickness, enhanced absorptive capacity, etc.) contribute to the development of localized knowledge spill-over cultures (Lendel, 2010, p. 213) and can culminate in an extended territorial footprint over time (Benneworth & Hospers, 2007). As RISs reach maturity, it is often the indirect benefits – including mobilizing the university as a hub for recruiting, training, and retaining regional human capital – that are of greatest importance for regional development (Berggren & Dahlstrand, 2009). This analytical and applied policy thinking, though, presents two key challenges when applied to university-led innovation in peripheral urban areas.

The problem of proximity

Within regional science and innovation literatures, knowledge spill-overs have long been closely associated with the idea of physical/geographic proximity between firms and universities. Studies in North America and Europe have posited that proximity is notably important for radical innovativeness and the transfer of new scientific knowledge and high technology content from universities (del Barrio-Castro & Garcia-Quevedo, 2005; Tödtling, Lehner, & Kaufmann, 2009). Productivity gains from industry-university partnerships tend to be highly localized, with companies situated near universities able to introduce innovations at a faster pace than rivals located elsewhere (Andersson, Quigley, & Wilhelmsson, 2009). This is a major rationale underpinning the notion that cities and regions can, and should, drive growth by capturing outputs from universities and high-tech research centres in their territories.
Despite a normative policy appeal, the actual impact of entrepreneurial spill-overs from universities is contested (Brown, 2016) and varies between regions with differing entrepreneurial cultures (Fritsch & Storey, 2014). Geographic space represents a valid proxy for the implicit channels along which knowledge flows, but it is insufficient, in and of itself, as an explanatory variable to make such channels explicit. Rather, physical distance in knowledge spill-over studies may be considered a ‘black box’ as it can be a proxy for other determinants of familiarity. To overcome this limitation, regional scientists have embraced alternative theories of proximity (Boschma, 2005). Cognitive, organizational, social, institutional, relational, technological, and geographic proximities are mutually-reinforcing competencies whose impact varies depending on the context under investigation.

Outside of so-called ‘high absorptive clubs’ (Caragliu & Nijkamp, 2016), the paucity of relational, cognitive, social, and technological proximity, in addition to elongated geographic distance, presents pertinent and pressing impediments for peripheral urban areas. Triple helix policy has been subject to analysis in peripheral regions at sub-national (Lazzeretti & Tavoletti, 2005; Potts, 2010) and supra-national scales (Labrianidis, 2010; Svensson, Klofsten, & Etzkowitz, 2012). Scholars suggest that the lack of ‘institutional thickness’ in such areas can open opportunities for strong university leadership (Raagmajo & Keerberg, 2017), and that less-favoured regions with high levels of organizational entrepreneurship but uncompetitive or fragmented local private clusters are more inclined to actively develop local knowledge networks and a common ‘development spirit’ (Garcia-Rodriguez, Gil-Soto, Ruiz-Rosa, & Gutierrez-Tano, 2017; Srinivas, Kosonen, Vlijmama, & Nummi, 2008). However, peripheral regions, by and large, have struggled to generate fertile innovation beds for university spin-offs as they lack the necessary mass of knowledge capital in their ‘territorial knowledge pool’ to support sustainable accumulation regimes (Benneworth & Charles, 2005).

Much extant research on university-enabled innovation continues to advocate for an enhanced regional development role for universities in such contexts instead of critically deploying growth theories and advances in economic or urban geography. Outcomes tend to concentrate on policy prescriptions for universities rather than engaging the spatial and institutional contradictions under which they operate (Tomaney & Wray, 2011), largely because they focus on the successes and failures of specific policies, not the political imperatives driving the actors involved (Brown, Gregson, & Mason, 2016). Greater attention needs to be paid to the complex spatiality of knowledge transfer, including networked and place-based perspectives, as they evolve in the twenty-first-century post-metropolis.

**Absent urban spaces**

Questions of urban and economic development are increasingly significant as the geography of innovation urbanizes. The elevation of ‘cognitive-cultural’ capital in the knowledge economy has emerged in an era marked by the rise of city-regions as economic and political hubs. Whereas technopoles and science parks had tended to locate on the outer peripheries of metropolitan regions – taking advantage of low-cost greenfield development sites to construct low-density sprawling and spatially-segregated campuses (Castells & Hall, 1994) – the suburban corridors and corporate campuses characteristic of Silicon Valley are giving way to concentrated and highly-urbanized innovation spaces. The connection between innovation ecosystems and their urban and regional geographies,
however, remains undertheorized. RIS thinking forwards universities as territorial actors but rarely holds the region itself as a critical object of analysis (Harrison, Smith, & Kinton, 2017, p. 1022). Cities and regions often appear as mere containers for predetermined social relations, not as essential environments that are constitutive of innovation processes.

In contrast, an established body of urban economic literature posits that the agglomeration effects of cities – the proximity, density, and diversity of people and social activities clustered in space – fundamentally engrain urban space as a critical site of advanced industries and innovation (Porter, 1998; Scott, 2008). Katz and Wagner (2014) conceptualize urban ‘innovation districts’ as mixed-use clusters which pool the economic, networking, and physical assets of urban centres into compact, connected nodes that are often ‘anchored’ to universities. Such physical sites are vital infrastructures for knowledge transfer. Innovation districts, in a sense, express the grounding of RIS networks in the built environment. They open urban places as a socio-material architecture to catalyse innovation through personal interactions, the co-presence of diverse actors, and implicit dissemination of tacit knowledge.

Innovation districts, though, also evoke an ontological separation between innovation activities and the socio-spatial terrains over which they play out. The extent to which this top-down urban regeneration impacts urban communities is debatable as policy and economic prescriptions concentrate on high value-added technologies and jobs that do not necessarily drive large-scale engagement with local SMEs. The growth of innovation districts can have mixed results for local employment; reinforcing skills gaps between specialized high-tech jobs and extant local labour forces who are more likely to be presented with entry-level service jobs and apprenticeships than sustainable advanced manufacturing opportunities. Connecting-up RIS and urban studies literatures, these issues can be effectively aligned with the notion of ‘splintering urbanism’ (Graham & Marvin, 2001) whereby infrastructural connectivity and bypass structure geographies of access and exclusion to urban resources. Using innovation districts as a tool for urban regeneration in deprived urban areas becomes problematic as proximity does not equal propinquity to the privileged economic spaces of the contemporary post-metropolis.

The challenges of urbanized innovation are not confined to ‘the city’ alone, politically or geographically. As urban areas rapidly expanding at their fringes, ‘post-metropolitan’ forms (Soja, 2000) present new scalar challenges for the infrastructural connectivity of place in social, material, and political terms. In an era of global urbanization, regional centralities/marginalities are produced at different scales. Uneven development at the inter-urban scale is reflected in the continued concentration of knowledge capital in global urban centres while intra-urban disparities disclose the dialectic co-construction of advantaged urban spaces and de-valorised and marginalized neighbourhoods. Here, universities contribute to processes of urban regeneration in ways that extend beyond the role ascribed to them in RIS approaches and are likely to be active over multiple sites and scales. They are central players responding to, and reshaping, urban structures in material and symbolic ways through the development of hard and soft infrastructures in place and via extended, trans-local networks.

Attention is now beginning to be paid to the post-metropolitan role of universities, including in Italy and the US (Addie, Keil, & Olds, 2015; Balducci & Fedeli, 2014; Rossi, 2016; Tomaney & Wray, 2011). We extend this emergent literature by addressing the symbiotic relationships between universities, regional innovation, and economic development
on one hand, and the socio-spatial dynamics of contemporary post-metropolitan regions on the other. Rather than compare pre-given bounded territories or self-contained institutional forms, our analysis is concerned with the production of urban and regional forms as they unfurl through the territorial, place-based, and networked peripheral spaces of the Naples and greater New York metropolitan areas. We acknowledge that the cases examine differing scalar, institutional, geographic, and governance contexts, but operate with a comparative relational theory of urban forms (and scales) ‘as open and constituted in and through relations that stretch across space and that are territorialized in place’ (Ward, 2010, p. 481). Per Addie and Keil (2015), engaging university-led urban and economic development as articulated in ‘real existing’ instances of peripheral urbanization deepens our understanding of: (1) the imperatives driving the discursive construction of universities as economic development actors, and the spatial frames over which their roles are articulated; (2) the material and governance technologies being rolled-out to support university-led innovation as an urban development strategy; and (3) the territorial geographies through which innovation policy and economic development are mobilized.

Regional innovation and the restructuring of the university and city in peripheral Naples

Naples is the capital of the Campania Region in southwest Italy. With a 2015 population of 975,260, it is the third largest municipality in Italy, while the 3,115,320 people living in the Metropolitan City of Naples make it the ninth most populous urban area in the European Union (EU). Naples occupies a position at the heart of the Campania innovation ecosystem, which includes seven universities totalling over 12,000 teaching and research staff and in excess of 26,000 students; 40 advanced research centres involved in technology transfer functions; seven high-tech districts; 21 public-private laboratories (focusing on aerospace, biotechnology, new materials, energy and agri-food, sustainable construction,

Figure 1. Map of University of Naples Federico II campus locations in Metropolitan Naples (figure by Miles Irving and Jean-Paul Addie).
culture, and transport and logistics); 25 science and innovation infrastructures (incubators, accelerators, science parks); and approximately 300 innovation start-ups (see Figure 1). However, in contrast to the post-Fordist ‘flexible specialization’ successes of the ‘Third Italy’, metropolitan Naples has found it difficult to position itself within the space economy of cognitive-cultural capitalism and continues to face challenges linked to its political and economic position relative to northern Italy.

**Talk: forging a regional innovation consensus**

Over the past two decades, public and private actors in Campania have escalated investment in research and development (R&D) as a means stimulate local economic development, with mixed results. From 1995 to 2005, Campania had the third highest ratio of public R&D expenditure among Italy’s 20 regions, while company R&D expenditure relative to GDP (20.8%) significantly outstripped the national rate (3.5%) between 2000 and 2005 (Del Sorbo, 2010, pp. 221–222). Yet the region has struggled to commercialize the scientific research emerging from this investment. Despite the established strengths of its universities – notably the University of Naples Federico II’s research excellence in science, technology, and engineering – and the production of science and technology graduate students at a rate close to the national average, in 2005 Campania only employed one third of R&D workers compared to Italy’s top-performing region and ranked 16th in terms of patents registered during 2000–2005 (Del Sorbo, 2010, pp. 219, 226).

The impact of the 2008 Global Financial Crisis galvanized a regional imperative to close Campania’s innovation-commercialization gap to the rest of Italy. The Regional Government (Giunta Regionale) of Campania has sought to strengthen regional resilience by shifting the target of local economic policy from building territorial R&D capacity to promoting knowledge sharing and dissemination through an inclusive, sustainable innovation ecosystem (Fascione, 2016). To this end, a new Campania Local Government Division (Assessorato) for Internationalization, Start-Ups and Innovation – the first regional ministry in Italy dedicated to start-ups – was established in 2015. One of the body’s first tasks was initiating a cross-sectoral conversation to promote patent applications and the industrial exploitation of intellectual property generated by researchers, students, and academics. Results from a Regional Government coordination workshop held with Campania university technology transfer officers in July 2016 highlighted the absence of: (1) a coherent governance architecture; and (2) a simple policy framework, as persistent barriers to regional innovation. In an unpublished working paper, government and university parties stressed the need to leverage common models of value creation and open-collaborative R&D to consolidate the Campania ecosystem, and proposed a series of programmes to strengthen the economic valorization of regional research capacity.

These conversations have served as a framework to galvanize multi-level governance buy-in regarding regional innovation policy, with the Italian Ministry for the Economic Development (MISE) working collaboratively to implement proposed actions. Significantly, the strengthening programmes have aligned the interests of the regional and national governments with those of EU regional Smart Specialization sectors. Campania’s research and innovation strategies for Smart Specialization (RIS3) are based on territorial policy priorities that match productive sectors and technology domains to promote growth around ICT, biotechnology, and new materials (Fascione, 2016). Moreover, as
Campania (alongside Puglia, Basilicata, Calabria, and Sicilia) has been identified as one of the EU’s sixty ‘less developed regions’, the territory is well-positioned to capitalize on €2.2billion in Cohesion Policy funds allocated across these southern Italian regions during 2014–2020 (European Commission, 2014).

**Technologies: restructuring technology transfer operations at Federico II**

For Naples’s oldest and largest research university, the University of Naples Federico II (Federico II), to adopt a more active role in the Campania innovation system, an intense three-year institutional re-organization was necessary.¹ In comparison to their American counterparts, which since the passage of the Bayh-Dole Act in 1980 have been legislatively compelled to commercialize outputs of federally-funded research, Italian universities have not comprehensively internalized the imperatives of academic entrepreneurialism. Prior to 2013, Federico II’s technology transfer operations tended to occur in an ad hoc manner indicative of large, multi-faculty research universities. In the absence of an organic plan, individual academics and research groups drove initiatives at the university level. In response, a new Statute was released on 15 May 2012 to define and assess all university structures and services, in accordance with Italian Law n. 240/2010. Starting from 1 January 2013, the University rationalized its scientific sectors into 26 departments, each with full economic autonomy and independent functions and endowments.

Reflecting the institutional progression outlined through Etzkowitz’s (2013) anatomy of the ‘entrepreneurial university’, the Federico II Technology Transfer Office (TTO) has emerged as a central node of pan-university activity. Radically extending its previous role (which interfaced solely with Federico II’s engineering departments), the TTO’s primary objectives now focus on: (1) making all University technology transfer initiatives coherent, cohesive, and systematic; and (2) developing actions to promote the economic valorization of the large-scale research activities carried out across all University departments. This expanded mandate has prompted on-going organizational experimentation to identify the most effective structures to oversee internal technology transfer actions, and respond to the needs and opportunities presented across metropolitan Naples.

The central concern driving the TTO restructuring is the need to address persistent barriers to patent applications and their industrial exploitation, including: (1) a lack of consulting firms relative to demand in Campania; (2) a lack of agreements between Federico II and private intermediaries regarding intellectual property rights (including the selection of partnerships/commercial sponsorships for the industrial exploitation of patent-products); and (3) the absence of a regional business model. Internally, the TTO has implemented mechanisms to monitor available patent endowments to verify consistency and develop an institutional understanding of the demand of both university and local innovation ecosystems. Externally, it has pursued framework agreements among local governments, universities, and consulting firms to guide patent registration, co-funding, and consultancy on licensing for transfer contracts.

Since 2013, much of the Federico II TTO’s work has focused on implementing University research in collaboration with industry partners. A strong focus has been placed on innovation and economic development in metropolitan Naples. The priority areas of technology transfer (aerospace, biotechnology, new materials) reflect the intersection of Federico II’s research specializations and the interests of Campania’s most-developed
industrial sectors. But collaboration with Federico II academics has also brought firms from other Italian regions into the Naples ecosystem, with several relocating their R&D activities. Initial results show a clear degree of efficacy regarding the reorientation of academic growth towards Federico II’s external environment (De Falco, 2015; De Falco, Polese, & Angrisani, 2015). This, in turn, has generated rising interest in university technology transfer among public institutions and policymakers. The TTO receives funding from a multi-level consortium of actors, but the Office’s financing highlights buy-in from national-level government entities. Funds obtained through PON and POR programmes (national and regional operative programmes, respectively) target collaboration between the University and the private sector around short- and mid-term research goals. Other important financial resources supporting technology transfer at Federico II have come from the Italian Ministry of Health and the MISE, as well as from several other research consortia.

** Territory: university-led territorial development - the San Giovanni University Hub**

The conjunction of regional innovation policy and university restructuring has engendered the development of new post-metropolitan spatial structures in Naples. Through a series of tax breaks, the Regional Government has targeted the revitalization of the historically-deprived east Naples district of San Giovanni a Teduccio as an urban innovation district. Plans for a San Giovanni University Hub propose regenerating a 200,000 m² coastal strip of Naples and adjacent suburbs via targeted investment in industrial sectors and research centres, and the development of campus facilities, and a conference centre.

Federico II opened the Centre for Advanced Metrological and Technological Services (CeSMA) in San Giovanni a Teduccio in 2012 (Figure 2). By consolidating new and existing laboratories working across the fields of engineering, physics, chemistry, and biology, CeSMA’s physical and social infrastructure is designed to promote interactions between Federico II and an emerging local cluster of high-technology enterprises and research facilities. Since September 2016, first-year students attending all Engineering undergraduate programmes can choose which location – the San Giovanni Hub (East Pole) or the Fuorigrotta Hub (West Pole) – to take courses as both provide comparable facilities and programmes. Building on this foundation, the Regional Government voted on 8 November 2016 in favour of allocating €45million to complete the San Giovanni University Hub; with €17million apportioned to develop the New Materials Hub of the Italian National Research Council (CNR) and €28million assigned for additional lecture rooms, offices, and research space.

Speaking in April 2015, Stefano Caldoro (President of Campania 2010–2015) lauded the opportunities made possible by the University Hub’s triple helix relations as a model ‘for both students and researchers in contact with firms, and for the private sector connected to the research’ (Regione Campania, 2015). Linking urban planning and economic policy, a transportation improvement plan has been implemented to enhance the accessibility of the San Giovanni University Hub, both for students traveling from central Naples and those coming from suburbs and peripheries across the metropolitan area. Public transit services now include two metropolitan underground lines (Linea 2 and Metrocampania Trenitalia), the Circumvesuviana, two tram lines, and several bus routes.
These physical investments are symbiotically-tied to a shift in Federico II’s cultural practices and ways of operating. Concerted efforts have been made to align the interests of university bodies such as the TTO and CeRITT (Research Centre on Innovation and Technology Transfer). New PhD programmes in engineering have been developed in partnership with SMEs. Most prominent, though, has been the establishment of the first-of-its-kind ‘iOS Developer Academy’ in a dedicated high-tech facility at the San Giovanni University Hub. Launched on 6 October 2016 by Apple CEO Tim Cook and (now former) Italian Prime Minister Matteo Renzi (with a €10million investment from Apple and Federico II), the Academy’s objective is to ‘provide its students the necessary competences and skills to become developers of innovative “apps” as well as trained professionals able to plan, implement, and commercialize innovative services on technological platforms’ (Regione Campania, 2016). Educational programmes at the iOS Academy are taught by Federico II faculty, but designed and supported by Apple. The first cohort of 200 students (expanding to 400 students in future years) will undertake a tuition-free, English-language-taught nine-month course learning to write code and design apps for iOS devices. Apple has also announced a new iOS Foundation Program in the Campania region (offering short courses on iOS app design) that will involve collaborations with at least five additional universities. The Campania Region Division of Internationalization, Start Ups and Innovation has embraced the Apple project. Not only have they offered scholarships for domestic and international students, but suggested the iOS Developer Academy itself marks the foundation of a regional network centred on Federico II, but with nodes to be located adjacent to other university campuses (Regione Campania, 2015).
Grappling with territorial and institutional (dis)connectivity in Newark’s innovation landscape

Newark is the largest city by population in the State of New Jersey (estimated 2015 population: 281,944). Excellent transport connections mean Midtown Manhattan can be reached in under 25 min via road or public transport, and Newark Liberty is the second busiest international airport in Greater New York. The city hosts several major corporate headquarters and a strong ‘eds and meds’ sector, with six universities: Rutgers University-Newark, Rutgers Biomedical and Health Sciences, New Jersey Institute of Technology, Seton Hall University School of Law, Essex Community College, and a campus of Berkeley College and five hospitals (see Figure 3). However, despite its connectivity to New York City, Newark is situated in a contradictory position in the wide metropolitan area, particularly with regards to innovation capacity. It is an infrastructural and economic hub in its own right, but legacies of post-industrial decline, racial tension, and pervasive deprivation mean the city is characterized as ‘desperately poor and degraded’ (Kantor, Lefevre, Saito, Savitch, & Thornley, 2012, pp. 102–103) and continually marginalized within its regional context. Proximity to New York’s global city core offers access to many potential benefits, including the near-record $5 billion in venture capital invested in New York metropolitan area companies in 2014 (Fischer, 2015). But as one commentator put it, Newark remains ‘a place so close to the start-up hub of New York, yet, in many ways, so far’ (Chernova, 2015).

Talk: framing universities as economic development agents

Although ‘town and gown’ relations in Newark have historically been strained, there is a clear recognition among municipal and university leadership of the important social and economic contribution the higher education sector makes to the city. Alongside its

![Figure 3. Map of Newark, NJ and location of select major universities and research centres in the Newark-New York City area (figure by Miles Irving and Jean-Paul Addie).](image-url)
strategic location, ‘diverse and underutilized’ workforce, concentration of corporate headquarters and arts institutions, and ample developable land, the City of Newark (2017) identifies the major universities located in the municipality as unique assets capable of enhancing the ‘vibrancy’ of the city. The quasi-governmental Newark Community Economic Development Corporation (NCEDC) promotes the city as ‘the strongest knowledge centre in the state’ and discursively centres its higher education institutions as ‘an incentive to entrepreneurs and key business industries that are looking for opportunities to grow or expand their business and access to talent’ (NCEDC, 2017). In line with trends across the US, universities in the Newark area have come to assume broadened economic mandates and social expectations. Interviews conducted for this study indicated that entrepreneurship training and access to commercialization infrastructures are viewed as major (although not exclusive) extensions to Newark universities’ educational offerings, in contrast to the driving role played by the Regional Government in the Campania innovation ecosystem. Universities, though, have adopted entrepreneurialism as an economic necessity as they seek to secure financial stability in a highly competitive marketplace.

While ‘entrepreneurial’ university practice builds links with business and governmental partners and internalizes such imperatives within academic education, research, and outreach (Audretsch, 2014), ‘engaged’ models of urban interaction mobilize a wider discourse tied to social mobility and the production of social capital (Watson, Hollister, Stroud, & Babcock, 2011). The latter approach is most evident in Rutgers University-Newark’s adoption of an ‘anchor institution’ strategic framework. Under the leadership of Chancellors Steven Diner (July 2002–December 2011) and Nancy Cantor (January 2014–), Rutgers–Newark has sought to reshape its relationship to the city through an approach that pursues the twin goals of being ‘an excellent university and a partner in the life of the surrounding community’ (Rutgers University-Newark, 2014, p. 6).

**Technologies: building infrastructures of innovation**

Shifting discourses and institutional expectations now position Newark’s universities at the forefront of the city’s revitalization. Concretizing collaborative triple helix frameworks has necessitated on-going processes of governance restructuring, in addition to the development of new infrastructures capable of formalizing a university-led development agenda. Although the Mayor and university chancellors and presidents continue to collaborate and are involved in discussions around the future of Newark, the NCDEC has emerged as the key agency through which the coordination of university-city interactions chiefly takes place. As a quasi-governmental body, the NCDEC has significant sway to direct projects in accordance with long-range development goals by bringing cross-sectoral partners and opens formal mechanisms for collaboration around specific initiatives and development proposals. In cases where such networking has been operationalized (e.g. working to bring entrepreneurship providers across Newark together), results have been viewed as highly productive for university and external partners. However, the NCEDC has limited institutional capacities and thus, any project targeting a specific development area would need to be housed within a university rather than a local government agency.

For peripheral urban places to effectively utilize their regional higher education systems, it is important for smaller institutions to connect with larger universities with deeper resources. There is a sense amongst local and regional political interests that
Newark has been successful here. For example, the Council for Higher Education in Newark (CHEN) brings together NJIT, Rutgers–Newark, and Rutgers Biomedical and Health Sciences to promote collaborative education and research, contribute to the revitalization of the University Heights neighbourhood, and support wider economic development agendas in the city and region. The process of building cooperative modes of working, however, is no simple matter. While CHEN has achieved a record of successful projects (for instance, partnering with the Newark Board of Education and others to establish Science Park High School), the scope of their activities and lack of spill-overs into surrounding neighbourhoods have been questioned. The universities and the City continue to operate with differing strategic imperatives that need to be carefully negotiated. Shared interests are not a given, especially when universities attuned to international STEM excellence interact with municipal authorities viewed as decidedly lower tech.

Forging successful interactions between academic institutions, and between universities and external partners consequently hinges on identifying and acting on mutually-consistent interests, capacities, and timelines. In Newark, the specific constellations of industrial/business activity, technologies, institutional expertise, available capital, and urban space has engendered a threefold approach to university-led development: (1) capital and capacity-building to grow technology start-ups; (2) university-led investment in large-scale research facilities (predominantly tied to life sciences and Newark’s hospitals); and (3) training in business and entrepreneurship for students (internally-facing) and local businesses (externally-facing).

The creation of Newark Venture Partners in May 2015 established a venture capital fund backed by the City of Newark, private-sector investors (including Prudential Financial, Dun and Bradstreet, Fidelco Realty Group, and Audible.com), and Rutgers Business School aimed at stimulating Newark’s tech ecosystem. The fund provides up to $1 million annual investment in seed and Series-A companies, while opening access to mentoring from corporate and academic backers. Tying this investment to the city, prospective companies are encouraged to utilize Newark ‘as a real-world lab for creating innovative technologies from transportation to education to smart city infrastructure’ (Newark Venture Partners, 2017). By the end of 2016, the Fund has invested in four companies and made accelerators investments to a further nine. Newark Venture Partners has also established Newark Venture Partners Labs; a 25,000 ft² accelerator space to attract and retain firms (Figure 4). Companies entering Newark Venture Partners programmes receive an $80,000 investment in return for a 5% equity stake and are provided with access to technical and business expertise from Rutgers’s students and faculty.

The accelerator and venture capital model being developed for the Newark tech ecosystem differs significantly from that needed for life science commercialization in terms of infrastructural needs, capital, and temporal horizon. Here, a $13.5 million investment from the State helped finance the construction of a new NJIT life sciences building featuring 24,500 ft² of wet and dry laboratories, offices, workspaces, and space for biotech start-ups and established ventures. Building from these physical investments, the New Jersey Innovation Institute (NJII) – a NJIT corporation formed in April 2014 – provides an institutional architecture through which academic knowledge and resources are applied to industry partner-defined challenges. NJII joined the U.S. federal government MetroLab
initiative in May 2016, a network of city-university partnership engaged in the ‘research, development, and deployment’ of smart city technologies.

The provision of the hard infrastructure of university-generated commercialization is clearly important for attracting companies and investment in Newark. However, the soft infrastructure of innovation and entrepreneurship is perhaps more vital in catalysing sustainable and resilient economic development induced in partnership with higher education institutions – as Pater and Lewandowska (2015) note in the European context. This is internally reflected in the shift towards entrepreneurial education and in the externally-facing programmes being strategically developed by Newark area universities. NJIT and the Stevens Institute of Technology (in nearby Hoboken, NJ) have embraced I-Corps entrepreneurial training (occasionally through the New York City Regional Innovation Network, NYCRIN) whereby a student, faculty member, and business mentor collaborate on commercializing a university-generated technology. Newark universities have also established in-house networking and mentoring programmes, including NJIT’s ‘People 2 Business’ programme and Rutgers–Newark’s ‘Entrepreneurship Pioneers Initiative’.

**Territory: struggles over regionalizing the regional innovation system**

The lasting efficacy of these infrastructural investments in catalysing resilient urban development opens pressing questions surrounding the scale of economic development activity, and the ability to integrate key institutional actors and peripheral areas into a wider
regional innovation system. Interviewees based in universities located in New York City noted the significance of the regional scale when engaging urban innovation. However, their geographic and institutional centrality buffers them to a great degree from the challenges presented by working across *intra*-regional jurisdictional and state lines.

Political and university actors in Newark are keenly aware of their contradictory position in the regional landscape. Clear tensions exist between the city’s role as a local/State centre and its peripheral position in the metropolitan and economic spaces of the wider city-region. The idea that New York City provides a wealth of resources, but resources that are removed from the formal institutional structures available in Newark, appeared as a recurring trope during interviews. A senior university official at a New Jersey technology-focused university reflected that while they could build strong personal relationship in New York, the absence of a strategic plan to tap into the city limited opportunities to develop deep institutional connections. This incongruence discloses the weakness of cultural and institutional proximity between New Jersey and New York despite their spatial and infrastructural congruence (Boschma, 2005). Distinct New York and New Jersey governance and business cultures reinforce State-based ecosystems. Although there is an increased interest in ‘working across River’ (west of the Hudson, at least), weak political, economic, and institutional connections continue to distance Newark from the resources and capital agglomerated in the global city-region’s core.

Inter-locality competition continues to play a defining role in shaping the region’s urban and economic geography. Since State’s activities stop at their jurisdictional borders, it is very difficult, especially for public universities, to operate with a spatial imaginary and strategic orientation that transcends entrenched political territories. Despite the nominal existence of a functional New York regional innovation ecosystem, territorialized governance dynamics within the region have crystalized internally at the sub-State level, with spatial and operational imaginaries tied to the territorial fragmentation and political geography of New Jersey.

**Comparative lessons and future directions**

Looking at Naples and Newark, NJ as examples of university-led innovation in the urban periphery reveals several commonalities across instances and institutions. The discursive frameworks spurring university-led economic and spatial development disclose comparable rationales regarding the capacity of knowledge-driven urbanism to revitalize struggling post-industrial places, and the critical moment of the Global Financial Crisis as a catalyst for material and policy action. The urbanization of university-led innovation necessitates the production of new economic and infrastructural centralities through which differing forms of proximity are realized. The architecture of innovation is not simply overlaid onto urban space or attached to pre-existing urban centralities. These material and governance infrastructures are essential components of the urban fabric and are central to its co-constitution. In this context, San Giovanni a Teduccio and the city of Newark should be understood as ‘in-between’ urban landscapes that disclose a palimpsest of spatial and developmental logics (Sieverts, 2003). They exhibit both forms of hyper-connectivity (through transit linkages and digital capacities) and endemic disconnectivities fostered as premium connections bypass social and material spaces.
The impact of geographic proximity plays out in an uneven topological fashion. In Newark, political (and associated financial) geographies do much to curtail the emergence of new institutional, cultural, and cognitive proximities, which show stronger maturation in Naples.

As we have discussed, the paradoxical position of peripheral urban areas raises challenging questions for those looking to leverage a region’s critical mass of higher education institutions, venture capital, technology companies, and tacit knowledge to stimulate economic growth locally, and across post-metropolitan space. The process of innovation varies significantly across regions depending upon: the competitive status of the universities present; the specialization or diversity of the local economy; and existing shared practices and norms. It also interpolates important ramifications for universities looking to contribute to their urban economic and social environments, making it is necessary for them to adopt distinctly spatialized engagement strategies. Variations in the culture and structure of national higher education regimes are evidently important in this comparison. The entrepreneurial governance transformations underway at Federico II have been thoroughly internalized by universities in the US. However, not every university can, or should, embrace the ‘entrepreneurial university’ model. Varied missions and communities can be served. As the case of Newark demonstrates, this does not limit involvement in localized innovation and economic development. Rather, competencies are being aligned (from leading high-tech research to training for e-services) to construct the hard and soft infrastructures of a more comprehensive innovation-led urban development approach.

Regarding territoriality, university-led innovation in peripheral urban areas is necessarily a multi-scalar game. Localized discourses and infrastructures are embedded in wider developmental political and policy agendas. The Naples case reveals two distinct territorial development logics being rolled-out at different scales. Firstly, the Federico II collaboration with Apple has been lauded by the national government as a way to partially rebalance the North–South divide long characteristic of Italian economic and social geography. This substantial place-based investment has been made with the expectation that a substantial portion of the locally-trained high-tech talent will remain in Campania, while Apple can take advantage of the lower costs of operation in Naples. As London School of Economics professor and Renzi economic advisor, Marco Simoni, put it: ‘An investment in technology in the south is a good idea because it is relatively inexpensive. If you set this up in central London the costs would be five or six times what they are here – not to mention the benefits of life in Naples’ (cf. Kirchgaessner, 2016). Secondly, the San Giovanni University Hub reshapes (post-)metropolitan spatial development in Naples, as the opening of a new Federico II ‘East Hub’ reorients the focus of both the University and transit provision away from the urban core.

Multiple scalar logics are also clearly at play in Newark, but reflecting the parochial nature of American ‘home rule’ politics, local, regional, and national development agendas often assume a competitive rather than collaborative dynamic. Newark’s proximity to New York affords the city a discursive and geographic lure. However, insofar as a regional innovation system exists, political, social, and cultural barriers persistently cleave meaningful fissures between the agglomeration effects of the global city core and its city-regional periphery. University-led innovation creates and regionalizes intra-urban dysconnectivity. Newark is pursuing a framework of high-tech urbanism, including

(Graham & Marvin, 2001).
an embrace of its higher education institutions, as a localized panacea for post-industrial deprivation and city-regional marginality. But at the same time, the drivers and discourses underpinning this approach cannot be divorced from New York City’s own embrace of university-enabled applied sciences and engineering, federal government initiatives surrounding the ‘smart city’, or the broader ascendancy of the Silicon Valley model of global city futures (see De Falco, 2018).

This exploratory research has established a comparative framework for analysing university-led innovation as an urban and regional development strategy. It has extended traditional regional innovation systems accounts by embedding debates on innovation policy within the multi-scalar spatial development of post-metropolitan areas. Our analysis demonstrates that university-led innovation strategies cannot be imported onto the tabula rasa of the urban periphery. New approaches being rolled out in Naples and Newark reflect contested processes of social production, concretized in distinct inter-relationships between the actors shaping policy and place, the conditions under which these are formed, and the results of their production. Policy and planning success necessitates building an awareness of the relevant discursive, infrastructural, and territorial agendas being pursued at alternative scales and the capacity to harness compatible resources towards targeted development programmes. Future quantitative and qualitative research is needed to systematically assess the impact and efficacy of these new university-led urban innovation infrastructures as they mature.

Note
1. Campania’s six smaller universities are starting to play a more significant role in regional technology transfer around their specific areas of research strength, but Federico II’s relative size, resources, and capacities means it has taken on a regional leadership role.

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