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INAUGURAL ADDRESS

The places of innovation

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Mijnheer de Rector Magnificus.

Dear everyone, here and online.

Today I want to take you on in a journey through the places of innovation. It will be a journey in space, as you might already imagine. But it will also be a journey in time, since I want to talk about the past, the present and the future. This journey allows me to introduce you to my chair in Geography of Innovation. I stand on the shoulders of many others, who have helped to make this label, cryptic as it may be to many here today, one that is associated with an established scientific field. This field includes theories, methods and policy proposals to which many researchers associate their work and are eager to contribute to. Admittedly, I came in this field at a point where many successes had already been achieved. And yet, exactly when you think you have seen it all, you realize that you were not looking enough or maybe in the wrong place. Hence, there are still so many questions to pose and to answer and that gives me the energy and the ambition to contribute to this field.

Before I dive any further, let me start by explaining what geography of innovation has been about.

First, what kind of innovation are we talking about? An often used definition of innovation is the one given in the Feldman and Kogler (2010) review: "Innovation is the ability to blend and weave together different types of knowledge into something new, different and unprecedented that has economic value." While many would associate innovation with new scientific and technological development, like a vaccine or an electric car, this definition talks broadly about 'different types of knowledge'. At the same time, it is clearly an economic definition. The innovations that economists and economic geographers are interested in are those with 'economic value': they lead to higher quality of products or lower costs of production, resulting in profits, job creation, new firm formation or even the emergence of whole new markets and industries.

The very label of this field has been made popular by Maryann Feldman, with her 1994 book titled 'The Geography of Innovation' (Feldman, 1994).

In that book she built upon insights from entrepreneurship, management and evolutionary economics, to tackle in a systematic way, both theory-grounded and empirically-based, the many facets of a geographical perspective on innovation activities. The list of contents of that book covers many classical questions that still define what researchers in the field are curious about: from 'why does location matter for innovation activities?' to 'how to understand regional innovation capacity'?

More than 25 years later, we have gathered an impressive set of answers, woven together in fascinating theories and convincing evidence. Geography of innovation is also a community, the GeoInno community, meeting at a biannual multi-disciplinary conference that in two weeks will be hosted at Bocconi University.

Having to pick the most popular stylized fact about the geography of innovation, that will have to be the message that innovation is strongly concentrated in space. Hence there are very few places globally that can claim to be 'places of innovation'.

This message has been proposed quite successfully by Richard Florida and his 'The world is spiky' maps (Florida, 2005). In these maps spikes correspond to places where companies register a large amount of patents. A patent is a legal right that is granted for new-to-the-world technological inventions. One can count patents granted to inventors active in a given place as a proxy for the technological innovation developed there. The maps show a rather 'empty' world with most of the globe being made of 'innovation deserts', and indeed only very few spikes.

At a time where people were declaring the 'death of distance' thanks to the digital revolution and the opportunities of globalization, the message was: location and proximity still matter, especially for those knowledge-intensive activities that rely on difficult to transmit knowledge heavy specialization of tasks, and specific investors and entrepreneurs able to cope with the high-risk nature of innovation activities,

More recent maps of patenting activity confirm the picture of a very few places globally that can claim to be innovation leaders. In these world maps coming from a WIPO working paper you can see the evolution in time of

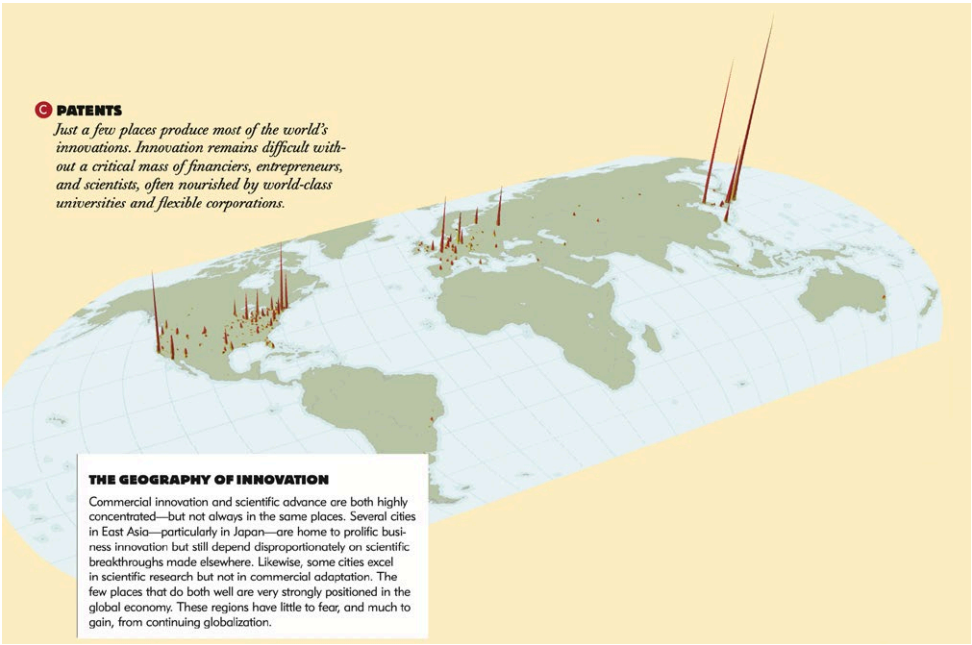

Figure 1: World map of patents, from Florida (2005)

the same patent spikes (Crescenzi et al., 2020). These maps tell two stories. First, that most spikes have remained spikes over the years and have in fact become even higher spikes Second, only a few new spikes have emerged, mostly concentrated in Asia and in particular in China.

This picture and its relative persistence over time, also imply that most places in the world do not matter for innovation activities. And if innovation is so important for economic development, are those places that are not on the map basically doomed and destined to enjoy lower prosperity?

While I do believe that there are strong processes at play that can explain these maps, my claim is that patent maps are only one way to identify places of innovation. I believe that one can draw different maps, telling different stories. At the same time, is it so important to be places of

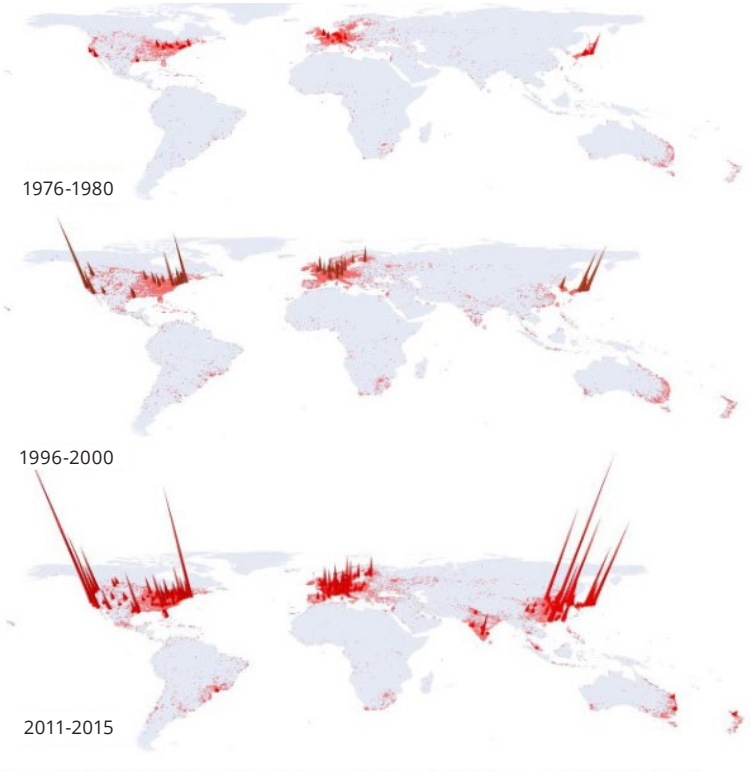

Figure 2: Evolution of the geographical distribution of patents (from Crescenzi et al., 2020). Source: WPO Statistic database. Notes: Data aggregated at county, NUTS3 or equivalent administrative unit.

innovation? And why? Luckily, I am not the only one asking these critical questions. If one takes a bird-eye view of the current trends in the GeoInno research, some clear developments can be recognized, in the theories, the empirics and the policy proposals.

Let me discuss where I see GeoInno heading to, by looking at four questions and how the answers to these questions have evolved over time. In doing so, I will focus on looking ahead to the answers we still do not have.

1 What is innovation and what are the places of innovation?

To start with the very definition of innovation, the sectors considered to be innovative and then also the places of innovation have clearly broadened. If we take as main narrative the one claiming that innovation concentrates in a very few places at the frontier of science and technology, then there are several counter-narratives emerging, the one more established than the other.

A *first* counternarrative, which has been rather successful already is the claim that innovation is not only about technological invention and that the places of innovation are not only science-based and high-tech clusters. By now we also take seriously innovation in sectors such as services, low-tech manufacturing and the creative and cultural industries. As I have showed with my own research, in collaboration with my former PhD student Matthijs Janssen (Janssen et al., 2015), but also with Sandro Mendonça (Castaldi and Mendonça, 2022), technology can still be an important enabler of innovation in these sectors but other elements of novelty, like groundbreaking design, revolutionary esthetics, alternative business models or novel organizational arrangements, play an even more decisive role. Unfortunately, these non-technological innovations are poorly captured in patent counts. If one wanted to draw the innovation map of the Netherlands, the Brainport region would correspond to a patent spike on the Dutch landscape, yet one would also want to recognize that Eindhoven has an amazing design cluster too. Similarly, our province of Utrecht hosts a thriving life-science cluster with the academic hospital as the driving force, but is also home to leading business services specialized in the built environment and a very successful gaming cluster. In my own research I have proposed to complement patent indicators with trademark data, building on work done together with Meindert Flikkema and Ard-Pieter de Man (see Flikkema et al., 2014, 2019). Trademarks are names or other signs used by companies to signal and differentiate their products and services. Innovative companies often register a new trademark when they introduce a new product or a new service in the market. They may do that *on top of* obtaining patents, like tech companies like Philips regularly do, or they may file a trademark *instead of* patents, for instance because their innovation is not technological. Hence, trademarks can allow to identify

different innovations than those captured by patent counts. Indeed in my research I have shown that a simple way to account for more and different places of innovation is to complement patent data with trademark data.

In these two maps (Figure 3) I illustrate this for the United States, where spikes are now circles, the larger the circle the more the patents or the trademarks, relative to population. In the blue map, Silicon Valley stands out as the place to be for technological innovation, as we would expect: it corresponds to a circle so large that it does not even fit in the figure. Silicon

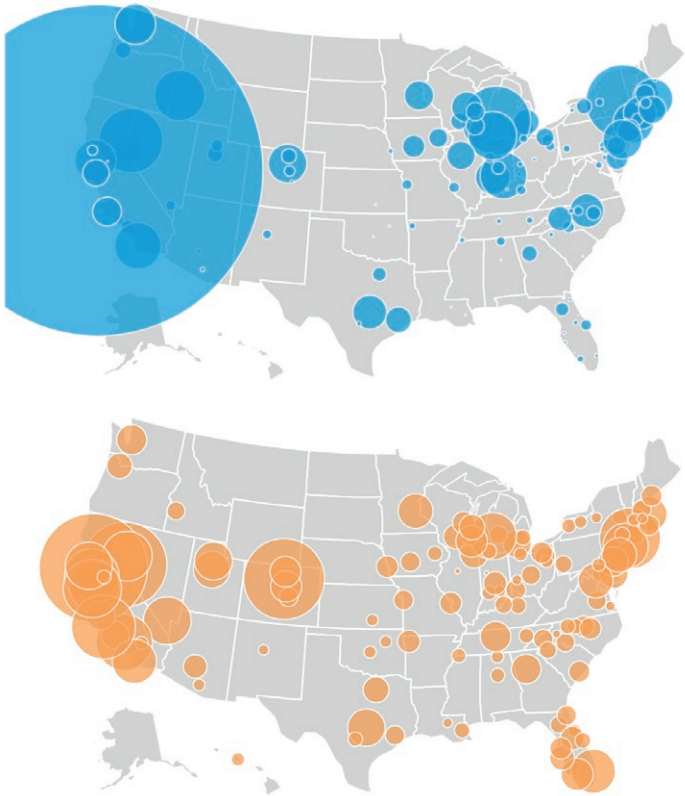

Figure 3: Innovation maps for the United States, based on patents (blue) and trademarks (orange)

Valley is associated with a large orange circle too, but it does not stand out so much anymore. Clearly, some places of innovation are the same in the two maps, but many circles are different, suggesting that some places focus on technological innovation, while some other focus on other forms of innovation. Also, the orange circles are also more spread across the whole country, which brings me to the next two points.

A *second* counternarrative has been to challenge the idea that larger cities are the ideal environment for innovation. While this idea may have elements of truth, it downplays the role that smaller cities or even rural areas may have. In fact, while young entrepreneurial firms may indeed benefit the most from the excitement, diversity and opportunities of large cities, firms that grow to become successful innovators have several incentives in locating in places where space is cheaper and workers might have better living conditions. Also, international comparative work shows that the concentration of technological innovation in large cities might be quite specific to the US innovation system, while in Europe many places of innovation are in small or mid-sized towns.

Connected to this point, *another* counternarrative is the one challenging the idea that innovation is about being in central places where 'the action happens' and the vibes and buzz are the right ones. While again this might be true for some types of innovation more than other ones, there is an increasing interest in understanding how peripheral places become places of innovation, against all odds. One intriguing explanation is that their very marginality, their being disconnected and lacking institutional support might give them an edge to come up with very original solutions, beyond the beaten path. Peripheral places might be in a better position to experiment, and there is evidence that a whole range of innovations, such as new path-breaking music genres, innovative architectural movements, but also resource-saving energy or housing solutions emerge in the periphery rather in the core.

And if we take a global perspective, much of the global south has been basically considered as a periphery in geography of innovation research. My own research has unfortunately only focused on Europe and the United States, which are the standard empirical settings in 95% of research. Yet, much of the action when it comes to innovation is shifting towards other

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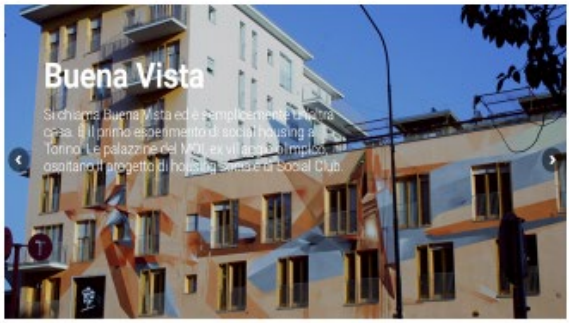

Alternative food networks at Porta Palazzo market

Figure 4: Impression of the places of innovation visited in Turin (Human Geography master excursion 2022).

parts of the world. With my PhD student Tingting Liu and our postdoc Deyu Li, I am actually venturing into the Chinese geography of innovation. Overall, we know very little about places of innovation in the Global South, much more research will have to come and I look forward to connect to the interesting work done by colleagues from International Development Studies and Spatial Planning.

Another counternarrative has pushed for going beyond corporate actors as the key innovation actors. Research on user innovation, innovation in public sector organization and social innovation by citizen initiatives, has convincingly claimed that much innovation generates beyond the corporate boundaries. If one reflects upon the 'micro-geographies' of innovation, innovators were mostly inside an R&D lab, later in front of a computer and now they are increasingly recognized to be out there in public spaces too, including neighborhoods, communities of practitioners, cultural centers or public institutions. Here I see many opportunities for connecting to exciting research in the related fields of urban studies, sociology and transition studies. In this respect the international excursion that I organized with my wonderful colleague Elisa Fiore last month was a real eye-opener for us and the students (see also the Linkedin post: https://www.linkedin.com/pulse/discovering-city-turin-uu-human-geography-master-2022-castaldi/).

Within the city of Turin, we visited so many places of innovation spread throughout the city: from the network of the Case del Quartiere (neighbourhood centers, see http://www.retecasedelquartiere.org/), to the open air market of Porta Palazzo where young farmers are investing in alternative food networks with new business models, to the Buena Vista social co-housing project (see https://www.buenavista.torino.it/en/), where passionate social workers are working hard to make their alternative housing concept a success. The variety of innovation happening was simply amazing and it felt as valuable for the city as the high-tech startup accelerators that we also visited.

Finally, a counternarrative of which we are only catching the very first glimpses, is the idea that places of innovation may not be physical ones, but instead be hybrid or fully digital ones. Here I mean the idea that collaborations and economic interactions increasingly happen in the digital space, being digitally-mediated or even digitally-augmented. There

are already digital worlds where you can trade digital artefacts or invest in digital real estate. The offline and the online are getting increasingly connected, and we still have to figure out what this means for the geography of innovation.

All in all, let me stress that these counter-narratives do not imply that the previous ones were all wrong. Rather, I see them as complementary, as they allow more complete answers to the question of what the places of innovation are.

2 Why do places care about innovation?

Within economic geography the traditional driver for places to invest in innovation has been to generate economic growth. National and regional policymakers have indeed bet on innovation as a key source of economic opportunities, including job creation, new industry formation and overall dynamism and economic resilience.

Yet, economic motives appear too limited, in view of several societal challenges that play a role locally and globally. Hence a so-called normative turn in innovation and innovation policy has emerged, and is also materializing into geography of innovation, as we claim in ongoing work with Christian Binz (Binz and Castaldi, 2022). It has done so in several ways.

As a first step, we have switched our interest to investigate the spatially uneven emergence of specific societally relevant innovation, for instance cleantech solutions or circular economy innovation: in which places do these innovations emerge? As a second step, we have started to recognize a 'geography of problems'. Places have different incentives to engage in societally relevant innovation, as some challenges will be higher in their agenda's than other ones. For example, while Utrecht may care most about housing, mobility and labor shortages, Groningen probably cares more about the energy transition and population ageing. Taking this lens, it is interesting to realize that large cities become places of innovation not only because of all kinds of advantages they might have, but also because many societal problems display striking urgency in urban contexts. Think of

mobility, social segregation, lack of housing. It is in large cities that these challenges push for all kinds of innovation, like we saw in Turin.

Overall, economic development is not anymore the main reason why places invest and engage in innovation, as broader societal challenges also play a role. Yet, the extent to which places succeed in pursuing specific directions of innovation clearly depends on factors beyond the control of one single innovation actor. This leads me to discuss the role of 'institutions'.

3 How do institutions matter for the places of innovation?

By institutions I mean those formal and informal rules of game that critically shape how actors and organizations operate and interact within societies. Think of regulations, norms, culture, political arrangements. Institutions will also shape those activities that directly or indirectly matter for innovation: from the ways in which innovators are able to secure finance for their risky endeavors, to the expectations of workers in terms of job security, to the cultural norms that shape the preference of consumers or the strategies of companies.

We have known for a long time that the institutional context matters for innovation. This has come with extensive work comparing first countries and then also regions in terms of their national or regional innovation systems. Taking institutions into account to understand places of innovation has been done in different ways: comparing liberal to coordinated market economies, something that I did in my own research with Bart Los (see Akkermans et al., 2009), but also accounting for the institutional quality of places, something that my colleagues Ron Boschma and Nicola Cortinovis also included in their studies.

Yet, these analyses have tended to focus on how institutions impact innovation rather than the other way around. From an evolutionary economic perspective, innovations come in two main flavors: the incremental type, which simply fit the existing ways of doing things. This type is the most common and happens in alignment with the existing institutional context. Once in a while the radical or breakthrough type of

innovation emerges: such innovation is instead about disrupting ways of doing this. New 'rules of the game' have to be invented and legitimized for these innovations to become the new 'normal': such alternatives may be proposed by institutional gamechangers including strategic entrepreneurs, enlightened activists or inspirational public officers. In instances of breakthrough innovations one witnesses a co-evolution of innovation and institutions. Examples of ongoing breakthroughs are the digital revolution, but also the energy transition or the emergence of more sustainable systems of consumption, all cases involving painstaking and contested transformations of the 'rules of the game'.

To give a non-technological example, one can also view Open Science as an example of a breakthrough innovation. Open science is a movement embraced by Utrecht University: it proposes moving from a closed science system, the so-called Ivory tower model where academics basically only interact with each other, to an open science system, where academics share science and create impact in society. Open science is prompting a redefinition of the relevant norms and values behind the scientific system, for instance through a radically different way of Recognizing and Rewarding academic performance. Open science as a breakthrough innovation is something that I wish to understand better, in collaboration with colleagues like Jarno Hoekman, Paul Boselie and many others connected to Open Science at UU. Individual scientists and whole universities are taking very different positions on Open Science and their institutional background might facilitate or instead stand in the way of embracing this radical innovation.

To sum up, institutional work in the field of geography of innovation is very much in the making but clear opportunities lie in connecting to research on the geography of transitions, institutional and social entrepreneurship, but also grassroots innovation, bottom-up initiatives and urban experimentation.

Our University might be one of the best places to engage in this direction, given the exciting research around the strategic themes of Institutions for Open Societies and Pathways to Sustainability. For both strategic themes, I truly believe that a geographical perspective is highly relevant. Let me explain why by tackling the fourth and last research question.

4 What does innovation do to places?

Geography of innovation research has until recently mostly focused on the benefits for places of innovation, presenting them as clear winners in the local and global markets, with little interest in the losers of the 'innovation' game. Yet, concerns about a 'dark side' of the geography of innovation are mounting. Following the three pillars of sustainable development, the 'dark sides' of the geography of innovation span all three pillars.

From an **economic** point of view, evolutionary economic geography, including the work of my colleagues Ron Boschma and Pierre-Alex Balland, has powerfully captured the success-breeds-success mechanisms that explain the time-persistent innovation leadership of a few places. These very mechanisms also imply that innovation can work as a major driver of inter-regional inequality and economic divergence. Hence, the success of a few places of innovation can create economic differences that are hard to bridge without policy intervention. What makes it trickier is that lagging regions are often those with the weakest voices in the political arenas that shape policies and distribute funds, like the work of my colleague Evert Meijers is suggesting.

From a **social** perspective, much innovation involves so-called skill-biased technological change, implying that innovative companies demand more and more high-skilled workers and also pay them disproportionally more. The direct consequences are labour market polarisation and income inequality, something that my colleague Sergio Petralia has clearly found in his historical work on the United States. My own research with Yuan Cai and Martijn Smit is also looking at how innovation has become a burden for US cities, by displacing groups of workers through its perverse effect on housing prices. These problems are particularly extreme in the Silicon Valley, *the* tech capital of the US. Praised as the ideal place of innovation that many regions worldwide have aspired to replicate, the Silicon Valley model, and the US institutional model of cut-throat capitalism that comes with it, increasingly appear as a highly problematic model of prosperity.

On the **environmental** side, innovation has often led to more production and consumption, with resource depletion as a consequence. Even

sustainable forms of innovation, like electrical cars, or our handy digital products and services, have a major environmental footprint related to the extraction of rare minerals. What is critical: negative environmental externalities have a geographically uneven concentration, as they often get shifted in pollution havens in far-away parts of the worlds.

Each of these three sets of implications represents a major 'dark side' on its own. But it becomes even trickier when considering them together. A key warning from sustainability researchers is that there might also be wicked trade-offs between the above three dimensions: what is good for the environment might not always be good for the people, and establishing what is 'good' or 'bad' is also complex. A geographical perspective would then add that what is good for a place might not be good for other places, hence it is critical important to consider both the local and global consequences of innovation.

Hence, a geography-sensitive analysis of the impact of innovation is strongly needed. This opens up a whole new research agenda that I look forward to shape and engage with. Which models of local and global prosperity are there and how do different types of innovation and institutions play a role in supporting or instead frustrating them?

For instance, can Europe really offer a different model of prosperity where the opportunities from innovation do not come with strong social inequalities? Can peripheral regions demonstrate innovative solutions with a better balance between economic, social and environmental impact? To what extent do digital technologies and digital platforms combine opportunities and threats for physical places? And how can policymakers keep track and act upon the directions of innovation that they deem most important?

Mijnheer de rector magnificus: I have discussed today how the answers to four key questions have changed over time and where research on the geography of innovation is heading to.

This has allowed me to sketch a research agenda for the coming years, for the field in general and for myself and my collaborators specifically. I look forward to developing this research agenda with current and new

collaborators, here in Utrecht but also nationally and internationally. I also hope that these topics will make students enthusiastic and willing to engage with the related questions themselves. And I also wish to keep connecting to corporate and non-corporate innovators, to policymakers and to other relevant stakeholders, to make sure that the questions and the answers remain interesting and resonate with real-world issues.

With this in mind, I look forward to the next years of research, teaching and engagement.

Mijnheer de Rector Magnificus: before I conclude, let me take some time for a few words of thanks.

[words of thanks]

Ik heb gezegd

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Prof. dr. Carolina Castaldi holds the Chair in Geography of Innovation. Her research deals with processes of innovation and how they unfold over time and over space. She uses theories and tools from evolutionary economics to account for the complex nature of innovation processes. Her goal is to develop a broad account of innovation and she has investigated extensively how innovation emerges in different economic sectors, beyond high-tech contexts only.

Within economic geography her work has drawn attention to diversity in knowledge as a source of regional innovation and she continues to investigate the role of innovation in regional development and the resilience of places. Her contribution also includes the development of novel indicators of innovation, exploiting patent and trademark data.

Prior to joining the Department of Human Geography and Planning, she held academic positions at the University of Groningen, Utrecht University (Copernicus Institute for Sustainable Development) and Eindhoven University of Technology. She was also a Robert Solow Postdoctoral fellow, right after obtaining her PhD from Sant'Anna School of Advanced Studies, Pisa, Italy.