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Innovation and development after the earthquake in Emilia[1]

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[1] This paper is the English version of a presentation of the ongoing research project Energie Sisma Emilia (http://www.energie.unimore.it) of University of Modena and Reggio Emilia (Italy) which aims at analysing the fractures that the earthquake brought about, not only in the physical structure of cities, but also in their socio-economic fabric. An Italian version of this contribution is published in the book edited by B. Oppi and S. Martello "Relazioni pubbliche e disastri ambientali" (forthcoming, BUP, Bologna). The project is coordinated by Margherita Russo and Paolo Silvestri and this work is co-authored by many authors. Nevertheless, section on public management is by Anna Francesco Pattaro and Marco Ranuzzini, section on manufacturing is by Margherita Russo and Manuel Reverberi, section on Agriculture is by Francesco Pagliacci, section on the credit sector is by Paola Vezzani, Elisabetta Gualandri and Alessia Pedrazzoli.

ABSTRACT

The 2012 earthquake in Emilia-Romagna (Italy) has shaken up the collective understanding on the socioeconomic importance of a vast territory that generates almost 2% of Italian GDP. The area affected by the earthquake is characterized by the presence of important industrial and agricultural districts, and by good practices of local governance that are internationally renowned. Private and public buildings, factories, offices and retail shops, historical and cultural heritage sites have been severely damaged. Not only, but it set in motion transformations in the socio-economic system that might have unexpected consequences and that undermine the quick recovery of the local system: different agents, at different levels, taking individual and collective decisions, generate a cascade of changes that interact with its evolution path. Indeed, earthquakes pose challenges, but provide unprecedented opportunities: strategic decisions by economic and political agents, newly available financial resources, coordination or lack of coordination among main stakeholders, and so on. The following paper provides an overview of the first results of Energie Sisma Emilia research project: it aims at collecting and disseminating relevant knowledge and evidence in order to design policies. In particular, it identifies the agents propelling innovation processes, and analyses their strategies in ever-changing environment. The paper starts with a socio-economic analysis of the area struck by the earthquake, followed by the results of three of the focus groups conducted. Eventually, it illustrates a specific innovation: the introduction and implementation of the digital infrastructure "Mude".

Key words: earthquake and its socio-economic effects; innovation and complex systems dynamics

JEL Codes: O14 – Industrialization, Manufacturing and Services Industries, Choice of Technology; O35 – Social Innovation; Q54 – Climate, Natural Disaster and Their Management, Global Warming;

Introduction

What development paths are taken in areas affected by natural disasters? Natural disasters like the ones which occurred in Italy after the Second World War, particularly earthquakes, flooding and landslides, have attracted increasing attention, not only from scholars, to the fragility of both urban and rural areas and the need for prevention programmes to mitigate the economic and social effects of natural disasters.

In economic literature (for example Albala-Bertrand, 1993a; 1993b; Tol and Leek, 1999; Okuyama and Chang, 2004; Benson and Clay, 2004; Strömberg, 2007; UNISDR, 2009; Cuaresma, 2009; Cavallo and Noy, 2009; Cavallo et al., 2010; The United Nations and The World Bank, 2010) the following idea prevails. In a manufacturing economy, an exogenous shock such as a natural disaster brings solutions that reactivate economic processes and improve existing conditions. In particular, the focus is on the effects that the replacement of capital assets has on industrial production, benefiting from the possibility to purchase cutting-edge technologies and techniques, as well as the multiplying effects of investments in the construction industry and other public works, which generate income from work and the demand for goods and services by families, businesses and the public administration. Other contributions (Geipel et al., 1990; DuPont and Noy, 2015) study the medium- and long-term economic effects, indicating how the path followed is not necessarily that which the affected territory would have been able to follow if it had not suffered the natural disaster. To understand whether in the medium-term disasters can become an opportunity for the improvement of the affected territories, we need to consider the local factors of development and the interrelationships between territories, as well as the interrelationships between the different administrative levels involved in the reconstruction processes. The fact that the amount of resources for reconstruction is not the only variable at stake is also demonstrated by Barone & Mocetti (2014) in the essay comparing the growth paths of two Italian areas affected by earthquakes, Friuli in 1976 and Irpinia in 1980: the latter received for decades considerable resources to cover the damage, but the area has not seen the transformation that one would expect considering the resources invested.

Reconstruction and, in particular, the extent of public and private resources invested to cover the damage do not seem to be a sufficient condition for trigger-

ing widespread opportunities for economic and social development. We need to explore the conditions that transform resources for reconstruction into economic and social innovations. With this objective, in this contribution we offer an interpretation of the first results of the research project "Energie Sisma Emilia". In particular, we aim to highlight which stakeholders are active in the innovation processes, underlining their role, relative position of power, their ability to implement strategies in a context of high uncertainty, occurring not only in the post-disaster emergency phase but also in the first years of reconstruction, given the resources available for reconstruction and the conditions to access them. The innovations we will analyse consider the artefacts (new public spaces, new construction technologies, new transport infrastructures, new administrative procedures) and the specific structures supporting the cascade of changes introduced by the many innovations generated in the reconstruction phase (such as the managing of the commission structure or the IT procedures for managing reconstruction funds).

Can we state that everything happening after a natural disaster is to be considered innovation? Referring to the case of the earthquake in Emilia, we will describe in which way reconstruction has triggered innovation processes in public actions (management of reconstruction, welfare and health will be the main examples), in business initiatives as well as in civil society.

The reflections offered in this essay are based on the first interpretation of the results of the research work "Energie Sisma Emilia". Started in September 2014 by a large research group from the University of Modena and Reggio Emilia[2], this project has two aims: by analysing the socio-economic effects of the earthquake at regional level, contributing to both building and sharing the knowledge required to foster the development of informed strategic decisions. The role of the university in the reconstruction process is in itself an element of innovation in the phase following a natural disaster: it is a key stakeholder, be-

[2] The research project "Energie Sisma Emilia" (www.energie.unimore.it) – co-funded by the Fondazione Cassa di Risparmio di Modena, the Modena Health Board and the University of Modena and Reggio Emilia - follows on from the "Earthquake Laboratory" which was set up in June 2012 by a team formed with faculty of the Department of Economics in Modena and students, together with researchers and professionals from outside academic research. The blog *ricostruiremeglio* (www.ricostruire meglio.wordpress.com) gathers the documentation produced in two years of activity, also thanks to the contribution of graduating students (Germana Ducato, Michela Passerini, Alfredo Pucci) and the internship conducted on the project by Riccardo Rimondi.

cause it is potentially able to create new knowledge required to respond to the questions accompanying reconstruction.

The earthquake in Emilia. The earthquake of May 2012 hugely marked the Emilia territory. With a population of around 550,000 inhabitants, the 58 affected municipalities constitute one of the country's most productive areas, producing almost 2% of the national GDP and offering a significant contribution to exports. The area has been the object of study for some time, due to the presence of important - industrial and agricultural – districts; for its governance and for a special balance between public and private action[3]. The material damage concerned mainly homes (around 31,000 were left uninhabitable), historical and cultural buildings, as well as buildings for health and social services and commercial and industrial structures, the reconstruction of which is a necessary condition for ensuring the recovery of economic and social activities. The idea underlying the project "Energie Sisma Emilia" is that the earthquake produced a series of fractures: not only those in the physical structures, but also in the economic and social system, the recomposition of which is not easy to predict. Businesses, public administrations, families seek solutions and responses to their own objectives, which are not necessarily the same as the ones they had prior to the earthquake, and which differ enormously according to the specific characteristics of the subjects (on different levels of power and decision making, and with different types of interactions inside and outside of the local system) and the time horizon on which they must/can be tackled.

Earthquakes produce criticalities, but at the same time they offer important opportunities which depend on a set of factors: strategic decisions, public funds available, the phase of the cycle accompanying reconstruction, the key stakeholders' ability for coordination, the ability to provide effective responses to the risks of infiltration of organised crime, the quality of the economic and social fabric where the event occurred.

In this contribution. Three years after the earthquake, disaggregated data on the damage is still not available and an analysis of the reconstruction as a whole has only just begun. In this contribution we refer, in the first and second part respectively, to a profile of the affected area and to the data available for character-

[3] These are the main characteristics of the so-called “Emilia model” (Brusco, 1982), which has recently returned to being a topic of discussion after the publication of some essays (cf. De Maria, 2012; Russo, 2012; Montella, 2013; Mosconi, 2012; Panarari, 2015).

ising the effects of the earthquake in Emilia. In the third part we present the results emerging from the focus groups held in the first phase of the research involving twenty privileged witnesses in the fields investigated here: local authorities (referring to public management), manufacturing sector, credit sector. Eventually, a specific section of this work concerns the "MUDE Emergenza Terremoto" – "Earthquake Emergency MUDE", the Single Digital Model for Building. We conclude this essay by proposing some thoughts on the innovation processes implemented in the reconstruction phase.

1. Profile of the area affected by the earthquake

Population and employment

The earthquake of May 2012 affected a very vast area, covering parts of Emilia-Romagna, Veneto and Lombardy. Huge damage was caused to the population, buildings and infrastructures. Of the three regions affected, Emilia-Romagna suffered the greatest damage: the epicentres of the two main earthquakes (respectively on 20 May 2012 and 29 May 2012) were both recorded on the border between the provinces of Modena and Ferrara. The 53 affected municipalities, in which the main damage was caused to housing, public buildings and production facilities[4], also lie in Emilia-Romagna. These municipalities, covering a surface area of 2698 km^2, are home to approximately 618,000 residents (source: 15^{th} General Census of the Population and Housing – Istat, 2011). The affected area represents 12% of the total surface area of Emilia-Romagna and 14.2% of the total population of the region.

In the period between the last two censuses 2001-2011, the population in the affected municipalities has increased due to the presence of foreign nationals in the area. There, the growth of population has been higher than that recorded at regional level (+13.6%, compared to the regional average of +8.5%). In 2011, the foreign population resident in the municipalities affected by the earthquake was over 11.2% (one percent above the regional average). In the same period, the for-

[4] The reference used is Ministerial Decree (D.M.) of 1 June 2012, "Suspension of terms for fulfilment of tax obligations for the taxpayers affected by the earthquake of 20 May 2012". Considering the classification proposed in Order no. 29 of 28 August 2012 (indicating 58 municipalities) here we have excluded all the provincial capitals (Ferrara, Bologna, Modena and Reggio Emilia) and the municipality of Argenta.

eign population almost tripled: the phenomenon of family reunification, which began in the 1990s, has been consolidated, explaining the relatively higher increase in the number of foreign women living in the territory. Today the population is balanced in terms of gender, a signal of stability in the territory.

In the whole affected area, there is a considerable increase in the population aged 0-9: this trend is attributable to the increase in foreign nationals in the area and the phenomenon of family reunification. In 2011, in the affected municipalities, 10.2% of the population was aged under 10, but this figure increases to 19.1% when considering only foreign people. The percentage of the (Italian) elderly population, aged over 70, increased to the same extent.

In the decade 2001-2011 employment figures dropped and unemployment figures increased, in line with the regional economy trends for the same period.

Agricultural sector

In contrast to key seismic events occurring in the past few decades, the earthquake of 2012 affected a densely populated area in the heart of the Po Plain, a highly industrialised area with high employment rates. Also for this reason, it has been too often forgotten that the area affected by the earthquake is in fact also one of the country's major agricultural districts, which was also very damaged by the earthquakes of May 2012. The area affected by the 2012 earthquake is therefore also an agricultural area with strong implications on rural life: in 2010, the 53 affected municipalities hosted 12,131 farms, covering a total of 187,100 hectares of utilised agricultural area (UAA), a total of over 2.8 million days worked, and 1,162 breeding facilities[5]. At regional level, the incidence in terms of agricultural activities of these 53 municipalities is therefore particularly high (17.6% of the regional UAA and 16.5% of the total number of farms). The incidence of the number of breeding facilities out of the regional total is slightly lower (9.2%).

It is worth reporting that these farms also have a considerable production diversification, with 87% of the UAA covering crops, as well as a specialisation in the cultivation of sugarbeet (33% of the regional UAA) and in forage plants, grapes (17.0% of the regional total) and fruit plants (17.0% regional, with a particularly significant production of pears). Animal husbandry is particularly wide-

[5] The data referred to here and below refers to the business centre of the farm (Source: 6th General Agricultural Census - Istat, 2010).

spread in the area hit by the earthquake (above all cows and pigs), and the average size of these farms is large.

Alongside the high proportion of crop farming, fruit and grape farming are particularly important, contributing to characterising the variety of the farming landscape in this area. At the same time, the farming sector in these territories by and large covers quality productions, which are highly competitive on national and international markets, as can be gathered by the importance, in those municipalities affected by the earthquake, of the quality productions (Fanfani and Pieri, 2013) and in particular PDO (Protected Designation of Origin) and PGI products (Protected Geographical Indication) are produced by 25.8% of the farms operating in the affected municipalities, covering 30.7% of their UAA and 45.4% of the days worked[6]. Referring to 2012 (the year of the earthquake), four of these productions were included in the ten main Italian productions in terms of turnover: Grana Padano (1,790 million EUR), Parmigiano Reggiano (1,316 million EUR), Balsamic Vinegar of Modena (262 million EUR) and Mortadella Bologna (223 million EUR) (Source Ismea, 2013).

Secondary and tertiary sectors

The General Censuses of Industry and Services held in 2001 and 2011 trace the conditions in the decade prior to the earthquake. From them, the extent of the effects of the crisis on the regional economic system clearly emerges: overall business employment increased only by 0.21%, while in the 53 affected municipalities there was a reduction of 6.3%. At regional level, the increase in the number of workers was driven by the tertiary sector[7] (+12.5%), contrary to the general fall in the number of employees in the remaining macro-sectors: -36.3% in the primary sector[8], -16% in the manufacturing sector, -4% in the construction sector. The affected municipalities recorded a drastic drop in the number of business units, attributable mainly to the manufacturing sector, one of the key sectors for the local economy.

Within the area affected by the 2012 earthquake, there is a strong specialisation of the engineering sector, both in terms of business units and employees,

[6] Moreover, when considering a broader definition of the affected area (58 municipalities) these territories cover the production of at least 9 PDO and 15 PGI products.
[7] The reference is to all of sections G, H, I, J, K. L. M, N, P, Q, R and S of the NACE Classification 2007.
[8] The reference is to all of sectors A and B, NACE Classification 2007.

while a drastic fall in both figures was recorded for the textiles sector. In all the territorial units analysed (region, area affected by the earthquake) the tertiarisation process is intensified, above all in terms of private services; however in the municipalities of the affected area the tertiary sector has less weight both in terms of employees and business units. In 2011, in the 53 affected municipalities, the tertiary sector represents 65.6% of the total number of business units and 43.5% of the total number of employees, compared to 74.7% and 59.9% respectively at regional level.

In the area affected by the earthquake, there is a larger percentage of people employed in the manufacturing sector: manufacturing activities[9] continue to represent 19% of the total number of business units and 46.7% of the total number of employees in these business units. This figure is considerably higher than the average one, at regional level (respectively 29.6% and 10.7%). Engineering, textiles and clothing, but above all biomedical (included partly in the "mechanical" sector and partly in the "rubber" sector) prevail more in the area affected by the earthquake than in the regional average. In particular, in the affected area, these three activities count respectively for 3.9%, 14.5% and 2.6% out of the total number of employees in manufacturing activities. Also in this case, these figures are higher than the regional average.

Although highly aggregated, these data provide a clear picture of the difficulties faced by most of the affected municipalities. Due to economic crisis, many sectors (from manufacturing to trade) had already suffered greatly, above all in terms of reduction in the number of jobs. The research project "Energie Sisma Emilia" is currently investigating the conditions prior to the 2012 earthquake in some key economic sectors in the area affected by the earthquake. The objective is to understand the specific dynamics implemented by the various stakeholders of the production system, local authorities and regional administrations to tackle the damage caused by the earthquake. After a brief overview on damages (section 2), this work reports in section 3 on three areas that have already been explored in the research: local authorities, the manufacturing sector and the credit sector. In addition to these fields, we will also refer to the process of computerisation of the funding management procedure: an example of how innovations introduced in an

[9] The reference is to the total of all activities included in section C of the NACE Classification 2007.

extraordinary regime of public action become part of an ordinary process, and can constitute factors for accelerating change. Section 4 highlights some critical issues and further research developments.

2. The damage and resources (public and private)

Housing

Data disentangled by year of construction for buildings and houses, are not currently accessible in the statistics of the last census. Nevertheless, for this analysis, key information would be that referring to the state of maintenance of single buildings (together with the relative building techniques). This is not available, although it would help us to understand to what extent the earthquake damaged those buildings, marked by poor maintenance. Out of the 15,803 homes damaged (affecting 25,427 residents) funds of approximately 1.061 billion EUR have been estimated for reconstruction works, against accepted costs of over 2.026 billion EUR. The funds widely cover the costs of reconstruction, and partially also seismic improvement works and the enhancement of energy efficiency. The differences between the different territories will be analysed in detail as soon as the disaggregated data is available by type of damage (according to the categories defined by the Aedes - *Agibilità e Danno nell'Emergenza Sismica* - sheets) and by place of intervention. Here we intend to investigate an aggregated aspect which is of interest for analysing the effects of the earthquake: the leverage effect the funds for reconstruction are having in the affected area. For every EUR of public funding, there are only slightly less private resources (0.90 €). These interventions and resources will have a considerable effect on the transformation of the centres affected, because they imply expectations of re-settlement by families, both for their primary residences and to recover part of the buildings destined for rental and the real estate market: these factors will contribute to the development of the affected area.

Agriculture

In July 2012, a first estimate of the damage caused by the earthquake was sent to the European Union by the Italian government: the 2012 earthquake caused over 13.2 billion EUR of damage, 5.7 billion EUR of which to productive

activities. Specifically, the damage to the agricultural and agri-industrial sector was estimated to approximately 2.3 billion EUR, the majority of which in the province of Modena: this damage refers not only to crops but also to agricultural machinery and equipment on the farms, as well as the stocks, which particularly affected the Parmigiano-Reggiano supply chain (Fanfani and Pieri, 2013).

Disentangling damages by municipality and by single agri-food sectors is a complex operation. In addition to the need to gather precise information on the funding applications, a similar estimate also demands the underlying assumption that the producers involved can reconstruct the damaged capital completely and identically. In fact, there is a possibility (partly already ascertained over the past two years) that the damaged farms will wholly or partly reorganise their production system, to make it more competitive and more sustainable in economic terms (Fanfani and Pieri, 2013). In the months immediately following the earthquake, many regulatory interventions were approved aiming to guarantee appropriate financial support to the agricultural and agri-industrial activities damaged by the earthquake. In addition to the interventions destined specifically to agriculture, we also need to consider the funds supporting business research, income support for employees and independent workers (through "social shock absorber" funds), funds for the temporary relocation of businesses, trades, professions and services (through the variation of the ERDF OP for Emilia-Romagna 2007-2013). While not directly destined for farms, these interventions in any case had a significant impact on the reconstruction of the production fabric of the areas affected by the 2012 earthquake.

Production activities

As far as production activities in the manufacturing sector and services are concerned, the estimates of the damages we can obtain from the "Sfinge" platform highlight funding applications for 1.828 billion EUR, mostly for buildings (75%), and in equal measure instrumental goods, stocks and relocation (12.5%). Disaggregated data by municipality and production activity is not yet available, but three years after the earthquake the reconstruction is by and large complete. These investments have a distinguishing feature: often associated to incentives offered by regional laws for innovation, an exceptional modernisation of technologies has been made possible, with a more efficient reorganisation of the factory layouts

and the relocation of buildings in industrial complexes. Although disaggregated data is not available for business type and sector, from the interviews held until now this direction seems to have been undertaken systematically by the industrial businesses (we will return to this matter below in the paragraph on manufacturing). The innovations have also concerned industrial buildings, allowing building types that today characterise the modern industrial areas of Germany to become part of the landscape in the area affected by the earthquake.

Public Works, Cultural Heritage, School Buildings

A total of 2027 interventions have been approved for public works, cultural heritage and school buildings, amounting to a total (gross of any co-funding) of 1,654.9 million EUR, around three quarters with public funds. The main part of the interventions and resources concern the cultural heritage (1,056 million EUR), followed by public works (409 million EUR) and school buildings (177 million EUR), the remainder of the expenditure (around 13 million EUR) is for interventions in public works and school buildings with minor damage (less than 50,000 EUR) or mixed building units. The municipalities of the affected area in the province of Modena are those where the damages are most concentrated, and maps 1-4 show the territorial distribution of resources pro-capita destined for the reconstruction of public works, cultural heritage and school buildings in the affected municipalities. While overall the distribution is quite concentrated in the most damaged municipalities, those closest to the epicentres of the earthquake, the distribution of school buildings is more concentrated in some of the municipalities: some municipalities such as Mirandola show a higher concentration of damage, but in other municipalities seismic improvement works were already underway in some schools, which greatly reduced the damage caused by the earthquake.

3. Reconstruction and processes of innovation. Four thematic studies: Public management, manufacturing, credit and computerisation

Within the project, some Focus Groups and semi-structured interviews have been held. From the interviews and Focus Groups held until now, we report on some data for analysing the reconstruction with reference to public management,

the manufacturing and credit sectors and the process of computerisation of building applications for reconstruction.

Public Management: pre/post earthquake

The Focus Group held in this field of research aimed to investigate the effects of the earthquake on local authorities, their internal organisation and in the services provided to citizens, businesses and the territory.

We contacted municipalities, as public entities acting as coordinator, interface or mediator of relations between the Public Sector (PS) and citizenship. For this reason we invited some civil servants working in the municipalities investigated in the research[10]. Those officers have managerial roles (in some cases they were "*dirigenti*")in some areas we identified as critical[11] for our analysis, so we asked them to report their own experiences in their specific area of competence. In effect the participants were asked to reflect on four key moments in the life of their administration: the pre-earthquake situation, the emergency immediately after the earthquake, the reconstruction phase and finally to frame some the prospects for the future.

From the first analysis of the materials emerging from Focus group it is possible to identify the following ideas and criticalities:

Priorities have changed. The earthquake brought drastic changes to the priorities of the municipalities, also concerning programming and planning. In this regard some examples were described concerning Mirandola. In particular, since 2009 the municipality had launched a wide-scale project on territorial *marketing*, which was quickly set aside due to the earthquake emergency. Prior to the crisis, like many Italian municipalities, it suffered from difficulties in making investments due to the national Stability Pact. Despite this, the administration was implementing an ambitious investment plan in schools and generally in the social

[10] Namely Cavezzo, Mirandola, Novi di Modena and San Felice sul Panaro,

[11] Specifically: budget, programming and control; social services and other services for different categories of citizens (including schools); public buildings (including schools); municipal and/or inter-municipal emergency plan managers; communication, information, dialogue with the local citizens and businesses, contact persons and coordinators of participatory projects.

sector; but also this plan was totally set aside following the earthquake. In addition also the new town plan (in Italian PSC - *Piano di Sviluppo Comunale*), which the municipality was implementing, was totally upturned following the earthquake. The reconstruction (and related town planning tools), were all transplanted onto this project.

The earthquake also produced a deviation between the theory and practice of the Emergency Plans of the municipalities, and in many other public entities.

Different social dynamics between the municipal administrations and the citizenship. While the participatory pathways implemented by administrations in "ordinary" situations are usually based on a well-defined project, clearly divided into sections and objectives, the example of the participatory pathways for reconstruction implemented in Novi di Modena required great flexibility in managing the relationships between citizens and institutions, and between different categories of citizens (young people/the elderly, ex-representatives of institutions, stakeholders …). Also as a consequence of different styles of government, not all municipalities experienced the convinced presence of the citizens in the dialogue opened up by the local governments, as can be seen in the difference between the paths run in Novi, where new associations were also founded (leading to a fragmented framework that the administration tried to reunite) and in San Felice sul Panaro, where instead the traders played an active part. The municipalities also had to handle fractures linked to different visions of the city, for instance those whose homes had been damaged and those not[12].

Emergency/reconstruction: a useful distinction? The distinction is not as clear and easy to identify as we might imagine: the emergency phase is not over, while the reconstruction phase began straight after every tremor.

The local authority budgets

Constraints. The constraints imposed on the local authorities affected by the earthquake, in financial and fiscal terms, are still not (much) different to those of other local authorities nationally. From this point of view, apart from some dis-

[12] The case of Mirandola emerged, where it was underlined how, after the first immediate phase of "damaged Mirandola", many citizens who had not suffered damage were no longer "tuned into the reconstruction": they continued to make cases that were important prior to the event, as if nothing had happened (in this case, the priority of the construction of a new multi-screen cinema in the municipality).

counts and benefits in the financial years immediately after the earthquake[13], national legislation does not seem to have treated the municipalities affected by the earthquake much differently.

The volume of work changed. What changed for the municipalities was the volume of incoming resources from national and regional governments . They were found having to manage far more resources, although also having to manage a much larger amount of provisions. In the offices, the dimension of the problems and the matters to deal with changed: for example, municipalities had widely to deal with information for and attention from local citizens and the media, which beforehand was much more limited. This aspect also brings another problem of internal operations: the delicate relationship between the necessary care for designing interventions (both in terms of investments and services), and the speed of the reconstruction interventions implemented.

Innovations in budget management. The post-earthquake period drove officials to introduce operational changes to their activities. For example, some municipalies decided to anticipate their own resources to fund reconstruction works in advance, knowing that such resources would be covered later by the regional and national funds destined for reconstruction.

Innovations introduced to the PA with the earthquake.

The debate in the focus groups highlighted various examples of innovations introduced into the public entities management as a result of the reconstruction after the earthquake. These innovations were more or less imposed, more or less appreciated but they anyway seem to have marked a change compared to how things were done before. Here are some examples.

"Creativity spiral" in the offices. The example given is that of Novi - but similar occurrences were reported in San Felice and other affected municipalities - highlighting how, with the birth of the COC (*Centro Operativo Comunale* - Municipal Operating Centre), very frequent meetings were organised during the emergency phase between politicians and municipal technicians, and between these and private technical figures. There was an intense period of dialogue and debate, marking an authentic example of *teamwork*. In many cases new ideas and ways of tackling the various situations were presented by the public officers them-

[13] For example following the earthquake, the Stability Pact was temporarily lightened in some parts for the affected municipalities.

selves. Very creative and at times chaotic ideas, at times the result of performance anxiety; yet in any case elements of innovation introduced to internal operations. Part of these debates in fact still continues today.

The "light enhancement" of the offices. In many cases during the focus groups it was reported that no great internal changes were introduced into the management of the offices, with particular reference to the municipality of Mirandola. What did change, as reported above, was the amount of work the offices had to deal with. In some cases, however, additional fixed-term staff were taken on in the municipalities to cover specific tasks, through the regional choices of the commission structure. These staff brought some changes to the internal organisation and the provision of certain services, becoming an integral part of the municipal administrative machine.

Communication needs. In all sectors of PS activities present in the focus groups, an increase in the need for communication towards citizens was recorded, not only during the emergency phase. The need for more communications led to internal innovations. In Novi, for example, it was the opportunity to completely modernise the municipal website, and to re-introduce, due to needs of transparency and *accountability*, a "traditional" communication formula consisting in the positioning of panels in the square listing the funds granted to private individuals. Also the responsible of municipalities financial sector (in this case Mirandola) saw an increase in the quantity of information requested by citizens concerning the use of the funds gathered for reconstruction. The representatives of the National Civil Protection Service had to make improvements and adopt innovations in their methods of communicating emergency situations (an example referred to an *app* for mobile phones being developed in this regard) after the widespread use of the social media in the period immediately after the earthquake.

Works that were not thought possible. In the Focus group the example of the new school campus in Cavezzo was described. The campus is composed of new buildings which a municipality like Cavezzo would not have been able to achieve in such a limited time, considering the public finance constraints imposed on the local authorities. Another example, again in Cavezzo, in this regard, was the "*Casa della Salute*" project. The earthquake also offered the chance to start public/private partnerships to (re)construct health care infrastructures for the community.

Innovations introduced by local authority policies. For example the “Tavolo 0-18” implemented by the municipality of Novi di Modena. This round table, part of the municipality's participatory efforts, offered the chance to think about the experiences of "forced cohabitation" the earthquake caused among the local population, which led to new ideas and needs expressed by citizens, such as those linked to *co-living* and *co-working*.

The relationship between different territorial levels

The Associations of Municipalities (*Unioni di Comuni*). From the debate, a difference emerges in the role played by the two Associations of Municipalities involved (Novi di Modena belongs to the *Unione Terre d'Argine* while Cavezzo, Mirandola and San Felice are part of the *Unione Comuni Area Nord*). In some cases the total absence of the Unione Comuni Area Nord in various areas of intervention/recovery was reported, underlining the image of a "suspended" Unione Area Nord during the earthquake period. It was also remarked that this Unione in any case, at least in part, offered mutual support among the municipalities, serving above all in relations with regional and national governmental tiers.

The case of the Unione Terre d'Argine was very different, since characteristics and competences were different and Novi was the municipality most seriously damaged by the earthquake, so it was therefore supported in this regards by the other members of the association.

The Emilia-Romagna Region. Some parties complained of the lack of responses from the regional government in a series of practical matters and internal management which continued to refer to regional provisions (for example in managing “earthquake-staff”). Some innovations introduced by the regional institution in the municipalities recovery and recostruction also emerged from the debate. In addition to the innovations in new public works, reference was also made to more "simple" matters, such as an innovation in the radios used by the Civil Protection forces, which completely changed some aspects of the working methods.

Criticalities/Priorities/Opportunities for the future

“Maintaining optimism”. In the municipalities hit by the earthquake, for example Novi, it was underlined how, despite the clear objectives set by the municipal government, there was a risk of "letting go". A “social bond”, as it was defined by one of the participants in the focus group, created after the earthquake,

needs to be maintained. This is linked to the fact that some of the technical staff, who came from outside to support the municipality in the management of the post-earthquake period, will soon finish their jobs, and this is also an aspect that needs to be considered.

The need for a general perspective. Mirandola represents one case where several times the communication manager reported on the need for a global vision. This requirement has implications for communication, but more generally refers to a plan the local government must have, with strategies and objectives which are currently partly missing, and which must be shared with the municipal technicians and the citizens.

Different speeds and times of reconstruction. The Mirandola participants in the focus group described the difference in timing between private reconstruction and the public works. In the latter case, we are still in the design phase, some resources are still missing, while in the former one the works are progressing more quickly. Linked to these aspects, comments were made on the historical centre of Mirandola. The participants from Mirandola referred how long it was taking to complete the reconstruction works in the historical center. A period of 7 to 10 years was estimated to be needed for the area to be fully functional again. The hope and trust in the reconstruction works remain, but people are aware of the length of time it will take for them to be completed. The situation in Cavezzo appears quite different since it is estimated that, once the works on the sports facilities have been completed, in 2016 the reconstruction works will be at a very advanced stage.

Manufacturing sector

The focus group was attended by (small and medium) businesses in the engineering, biomedical and clothing sectors. Some businesses belonging to multinationals also took part. The eight businesses - each with its own specific perspective, experience and area of competence - described how they managed the emergency phase and the start of the reconstruction works, outlining their medium-long term strategies.

Before the earthquake

The economic crisis. The economic crisis did not affect all the manufacturing sectors represented in the FG in the same way, and many of the companies

recorded significant growth rates up to 2012. The sector most affected by the crisis was the engineering sector (three of the companies present), with the exception of one company producing machinery for the agri-food sector. In the biomedical sector, on the other hand, the situation was very different for the subcontracting companies compared to the multinationals. More than drastic reductions in turnover, the subcontracting company had to tackle problems linked to the greater uncertainty in its relations with its main customer, which at the same time was starting a process of internationalisation of some of the production phases, relocating other phases abroad. The representatives of the multinationals present at the focus group reported that, operating with their own brands on the world market, the companies had not felt the effects of the crisis.

Identification of the pre-earthquake period. Identification of the pre-earthquake period varies greatly from one sector to another, in some cases this phase began with the economic crisis, in others it began in the mid-1990s (textiles), following the generational turnover in company management, after the acquisition by a foreign multinational, or when it was decided to diversify production in order to focus on sectors which at that time were considered strategic.

Competition and business strategies. Before the earthquake, the companies present at the focus group were affected by profoundly different forms of competition in terms of both nature and intensity. The strategies adopted were therefore equally different: in some cases the companies aimed to increase their technological levels by investing in new machinery, to satisfy the requirements of customers and recover lost market shares; in other cases the strategy adopted was that of market repositioning, offering exclusively products with high added value, while other businesses chose to diversify production and broaden their sphere of competence. The increased level of competition appears to be a common feature of almost all the companies present (with the exception of the world leader in the fruit peeling machinery niche): in some cases this competition is outside the company, but in others it is also competition between different companies in the same multinational.

Business transformations. In the pre-earthquake period, the majority of companies reported profound organisational changes and changes in the company management. In some cases, for small businesses, this was a generational turnover, in others the change was due to the company being bought out by foreign

multinationals. Overall, all businesses present at the meeting recorded an increased in turnover and in the number of employees in the period prior to the economic crisis or for those affected in any case in the period prior to the earthquake. Some of these, just before the earthquake, had just introduced drastic modifications and innovations into their production processes, buildings and machine technologies.

Emergency phase and post-earthquake reconstruction

A collaborative response and immediate recovery. The earthquake did not cause any deaths or serious injuries in any of the companies present. The strong shock suffered by the various testimonials at the focus group emerged in their memories, thus bearing witness to the difficulties of a personal experience in which the fate of the business, the family and the community of employees becomes the key pillar of the reaction to the disaster. Not always with the required lucidity, but in all cases marked by a clear cooperative response from the workers, the management of the multinationals as well as between companies, to ensure that production could be resumed as quickly as possible and the sample collections, materials for delivery and stock and machinery could, where possible, be recovered without suffering additional damage.

Temporary relocation. The damage of the earthquake brought logistic difficulties in the cases in which the production had to be temporarily relocated, to find a site where the business activities could be resumed. Some businesses had trouble in correctly estimating the costs of relocation, coming up against poor flexibility in modifying the files uploaded onto the Sfinge application.

Relations with customers. For some companies, the interruption of production, even for a short period, also implied problems in the relations with customers, and in some cases the temporary or permanent loss of business. For other companies, such problems were not reported as the comparative advantage of their products made them irreplaceable, at least in the short term.

Problems linked to common management and bureaucracy. In building complexes hosting several companies (condominiums) some friction was reported due to the fact that obtaining the final structural approval of a single company required that of the whole condominium; this problem was significant because the last instalment of reconstruction funding is granted only once the building has obtained final structural approval.

In the emergency phase and the period of reconstruction after the earthquake the companies had, several times, reported their difficulties caused by the bureaucratic system to the local administrators and associations. In particular, fulfilling the obligations of warehouse accounting, in a period in which many of these were seriously damaged or inaccessible, or when the companies were relocating their production activities to and from their usual premises. Another problem reported was that some safety works had been started (or even completed) before the entry into force of the law which, for access to funding, required appointments given only to companies in the white list (art. 5-bis of Decree Law (D.L.) no. 74 of 6 June 2012): this law was introduced precisely in the emergency and post-earthquake reconstruction period, but many of the works had been necessary before the law came into force.

Resources for reconstruction. In the case of insured businesses, decisions on interventions were greatly facilitated. In the case of multinational companies the large availability of resources greatly facilitated the ability to overcome the emergency phase. The law granting soft loans for the payment of taxes and national insurance freed resources destined for further investments and to cope with the lack of economic resources deriving from the delay in trade payables. Moreover, governed by orders 91 and 158 of 2013, several companies applied for and received funds to eliminate structural weaknesses and improve the seismic condition of their premises. Some businesses also applied for funding from the European Regional Development Fund, aiming to support investments and processes of technological and administrative change (capital grants up to a maximum of 45% of admissible expenditure and in any case no more than 200,000 EUR).

Cooperation in the district. The companies, above all in the engineering sector, with a close network or productive relations, reported particularly cooperative phenomena in the post-earthquake period. Some businesses were assisted in the production of particular orders by companies with whom they had collaborative relations within the same business network. In one or more situations, the damage caused by the earthquake caused the companies to face the problem or relocating production. In some cases, they were hosted in other companies, or they themselves offered to host a company whose production facilities had suffered damage and could not continue to operate there. In both cases, although temporary, these

conditions led to thought on the organisational difficulties, but also on the potential of a similar work organisation.

Workers, a business asset. All the companies present underlined several times that their employees represent an important asset for the company, even more so in an emergency situation like that of the post-earthquake period. In addition to their hard work, the desire to resume operations in the company they work for, the owners highlighted the highly specialised skills of their workers, skills which often the company creates in-house, given the clear gaps in the local education and training system.

Medium-long term prospects

In analysing the medium-long term prospects, some comments emerged on the problems and opportunities of the post-earthquake phase.

Criticalities. One critical aspect emerging from the discussion was the clear belief that the future (for the biomedical and engineering sectors) will be marked by a drastic increase in the level of competition, not only based on price but also on the quality of the products supplied. This aspect touches on the delicate issue of technological innovation, both of production processes and products, as well as training. Secondly, the companies performing outsourced services for the biomedical sector underlined how the strategy is that of becoming "complete suppliers" above to provide services to large multinational firms. Finally, the development of production appears to be greatly conditioned by the very poor infrastructure in the area, which leads to serious economic damage altering the competitive performance of businesses. Three areas were identified as extremely critical: (1) the chronic lack or unsuitability of the transport infrastructures (overload situation on the SS12 and the Cispadana route still not completed, despite being planned in the mid-80s); (2) lack of appropriate digital infrastructure (no fibre optics in the area); (3) problems of discontinuity in the mains electricity causing damage to the electronic equipment used in the biomedical sector.

Opportunities. The economic and financial conditions, the available skills, but also - for the multinationals - the increased reputation enjoyed with the parent companies, have made it possible for all companies present at the FG to relaunch a growth process to recover the pre-earthquake situation: by expanding their production facilities and warehouses, renewing technology, reorganising the machinery and equipment layout, risk management analysis and process reorganisation,

but also new organisation of the management and ownership to cope with generational turnover (experimenting investment funds in the company ownership). An improvement in terms of production efficiency and greater competitive performance which was obtained within a strategy of business expansion.

According to some participants in the focus group, the earthquake brought a change in the way of thinking and acting, changes which occurred both in the company management and in the public institutions, and thanks to which these organisations now operate with a more medium-long term vision. It is as if the earthquake had relaunched the idea of project planning which the pre-crisis dynamics had lost sight of. From the experience gained after the earthquake some of the participants underlined how, in future, it is important not to neglect the importance of the high levels of know-how in the district, and at national level the current favourable, or at least improving, situation in Italy must be exploited to the full.

Matters to analyse

The eight business representatives present at the focus group clearly described the dynamics of the various manufacturing sectors before, during and after the earthquake. They also offered some ideas for future research. However, there were no (generally small) services companies, which play a fundamental role in the district, and which could have experienced very different phases and conditions. Another aspect, to be considered in future phases of the research, is that in creating the focus group the companies selected very probably represent success stories. It is indeed probable that those companies which are still in difficulty three years after the earthquake (bankruptcy, closing, or still on the road to recovery) were not willing to take part. From the analysis of the business demography by sector, class size and municipality, we will select a group of these companies to conduct further interviews. Another aspect to be considered is the analysis of the asset and financial structure of the companies in the area affected by the earthquake, and in particular to what extent the resumption of productive activity was supported by recourse to credit. Finally, a matter that still has to be tackled is how far the post-earthquake reconstruction can in itself constitute a deterrent for the birth of new businesses: for the next 4-8 years, the historical centres of many of affected municipalities will remain partly inaccessible (due to the slow and complex recovery of the historic and monumental heritage and the building sties still

open), the structural fragility to be overcome could get worse, the local scale without any strong connections may not attract more dynamic businesses and neither the natural turnover for those family-run businesses which close due to the retirement or withdrawal of their owners. A weak, or negative, demographic dynamic could have serious consequences for the area as a whole, also because the more dynamic businesses would find themselves in a spiral of weaker external economies and fewer opportunities for sourcing local skills or attracting them from outside the area.

Credit sector

The main purpose of the credit Focus Group was to investigate the effects the earthquake had on the credit sector, and in particular the way in which the banks had to manage the emergency phase initially and subsequently the granting of funds for reconstruction.

Emergency phase

Resuming services. For all banks with branches in the affected area, the earthquake that caused most damage was that of 29 May. In particular the branches of groups with headquarters in the historical centres of the municipalities in the area hit by the earthquake were affected. To tackle this emergency and ensure the continuity of the credit services, branches were set up in containers and travelling camper vans. From the various testimonials it emerged that in the first few months after the earthquake the main service needed was that of the provision of cash: at that time, nobody was able to think about reconstruction or possible funding.

Management of human resources. The employees of the branches that were temporarily closed were transferred to outlying branches. In the case of San Felice 1893 Banca Popolare, the transfer of the main headquarters to Modena involved the payment of incentives to compensate for the difficulties caused by extra travel. Some banks provided a free psychological support service, and paid leave to employees to help them overcome the emergency phase more tranquilly.

Business Continuity Plan. From the discussion among the participants, it emerged that after the earthquake the *business continuity plans* were strengthened. The provisions introduced to reduce operating risk aimed above all to improve computer security, thus reducing the vulnerability of banks in technical and organisational terms.

The reconstruction phase

Credit institutes played a key role in two fields during reconstruction: relations with the inland revenue and funding for reconstruction.

Relations with the inland revenue. On 5 November 2012, ABI and Cassa Depositi e Prestiti (CDP) signed the first agreement to postpone tax payments, national insurance and social security contributions due to the inland revenue by business owners. The CDP made available a maximum limit of 6 billion EUR to the banks, postponing the obligations of the period May/November 2012 and the amounts due from 1 December 2012 until 30 June 2013. The participants in the focus group stated that 10 days after the publication of the moratorium they received over 1,000 operations, performed in the span of a week thanks to the establishment of task forces. The postponement of the repayment terms, currently set for 30 June 2016 may however imply a series of risks. Many companies have accumulated debts and will have difficulty in repaying the amounts on the due date, the effects of which will fall on the credit institutions but also on the companies themselves, who will see their funding revoked.

Funding for reconstruction. In the first two months following the earthquake the banks had the perception that the Region could have trouble in funding the reconstruction, so every bank started to formulate forms of soft loans. In July 2012 the first instalment of funding worth 2.5 billion EUR was issued, and in December of the same year the second, worth 6 billion, for repairs and reconstruction works on property damaged by the earthquake. The banks participating in the operation were originally all those with the technical capacity to manage the payment of funds, and presented a price list of costs for managing the applications. Although in this phase the role of the banks appeared to be merely executive, a series of criticalities emerged in particular in managing to make the customers understand the nature of the operations (often bottlenecks are created in the administration of procedures due to the incorrect presentation of the documentation by private customers and consequently a block in transferring the funds from the bank to the business).

Medium-long term prospects

From the discussion among the participants it emerged that the current phase is considered a period of transition for many sectors. Some are in difficulty, while for others it is a growth phase. In the biomedical sector, the earthquake gen-

erated opportunities for increased efficiency which would not have been possible otherwise. The multinationals recognised the availability of skilled staff and technological innovations developed in the sector, continuing to support the investment process. SMEs with high innovation and strong commercial internationalisation have been able to reap the opportunities of the earthquake to renew their business. The sectors which on the other hand have accelerated a process of decline which was already in progress prior to the earthquake are trade, real estate, the construction sector and textiles SMEs. In particular, in the real estate sector, the participants acknowledged that the earthquake will be help to raise prices, as the value of many unsold buildings will be lower than that of buildings rebuilt after the earthquake.

Topics for further study

One aspect to be considered in the coming phases is the financial architecture which has supported the reconstruction process and in particular the relationship between the CDP and the credit institutions. A further element for analysis is the sequence of legislative acts issued for the moratorium on taxes and the "Earthquake 2012 Reconstruction Ceiling". We will also investigate the role of insurance undertakings in the reconstruction phase.

Computerisation of building permit applications for reconstruction

With the "MUDE Emergenza Terremoto" project, the Emilia-Romagna Region placed leverage on the processes which had already been started prior to the earthquake with a relaunch which in a very short time aimed to manage the extraordinary processes of granting loans for building reconstruction. A path which deserves attention for the implications it may have in accelerating change also in the management of ordinary procedures.

Acceleration of processes started but not yet implemented

The 2012 earthquake represents the first case in Italy in which the management of applications, allocation and payment of grants for repairing homes damaged by a natural disaster have been fully computerised. The MUDE (Modello Unico Digitale per l'Edilizia - Single Digital Form for Building) is the computer platform used in Emilia for this purpose. This is an example of the innovations brought to the public administrations by information and communication technologies, but the context is not that of normal planning, but rather that of the post-

earthquake emergency. There are three key points of this innovation: the acceleration of processes of creating a tailored “Earthquake Emergency MUDE” product (to manage grant files); the creation of a network of competences required to support its effective implementation; the multitude of stakeholders involved in the procedure and their roles. A fourth need must be considered: the implications that this process may have in the generalisation of the region-wide ordinary management of building applications, as well as the management of funding for the post-earthquake reconstruction.

The MUDE before the earthquake

Italian Law no. 80/2006 introduces the "Modello Unico Digitale per l'Edilizia" (Single Digital Form for Building, hereinafter MUDE) as a tool for simplifying land registry and building administrative procedures. Its purpose is the computerisation of permission granting for private buildings in the municipalities and the correlation with the relative land registry requirements (the real-estate - taxation process managed by the Local Agency). Since 2006 the specification and operations of this innovation have been appointed to various national projects, but there has been no clear definition by the national legislator on the operational instruments for implementing the MUDE throughout the national territory, nor a single evaluation of the ability of the system to provide instruments and skills for managing it. The agreement between the Umbria, Piedmont and Emilia-Romagna regions marks a first step in the creation of a platform for digitalising this process. The Piedmont Region developed and used the “MUDE Piemonte” platform on a regional scale, operational since 2011, involving many other Piedmont local authorities through cooperation agreements and based operationally on the ICT infrastructures developed by the Consorzio Sistemi Informatici (CSI) in Piedmont. Even before the earthquake, the Emilia-Romagna region had begun experimenting on MUDE, aiming to transit towards Sieder (Sistema informativo per l'edilizia del territorio regionale - Regional Territorial Computer System for Construction). This project aimed to create a regional computer system allowing all stakeholders in the building process, in any part of the region, to interface with the municipality through a computerised procedure. The aim is to allow citizens to transmit all building applications and procedures and standardise the forms used. Experiments had begun in the municipalities of Modena and Bologna: each highly innovative experiment focused on specific aspects of the process, for example the develop-

ment of certain stages, such as the pre-registration of a building or the collection of documentary materials for certain procedures.

From experimentation to uniform implementation in the post-earthquake phase

Immediately after the earthquake, the first orders on private building reconstruction, issued by the Commissioner Delegate, clarify that the funding application can only be drafted using the specific computerised procedure set up by the commission structure. From 2012, therefore, the "Earthquake Emergency MUDE" was adopted as the sole instrument for the exclusively computerised design of the authorisation proceedings for allocating funding for the reconstruction of buildings[14].

An *exogenous shock* such as an earthquake, therefore, transforms what was previously a project being experimented into ordinary practice in the administrations affected by the earthquake.

Processes of innovation in the management of Public Administration activities require the synergy of a revision of organisational processes, the introduction of new technological systems and the training of the staff involved in the new processes. The case of the "Earthquake Emergency MUDE" demanded quick action, and therefore this synergy was particularly complex. First of all, in technological terms, the MUDE experiments in progress in the region, while highly innovative, were not able to support the necessary integrations to tackle the management procedures for the funding applications for building reconstruction. The cooperation which had already begun between the Emilia-Romagna and Piedmont regions ensured the very quick implementation of a platform which had already been tried and tested on a broad scale, the one developed by CSI Piedmont. Specific procedures were developed on this platform to adapt it to the needs of managing post-earthquake funding. The revision of internal processes in the organisations in order to implement this innovation, on the other hand, required firstly the identification of the bodies which were to be in charge of these new processes. And this is another peculiarity of the "Earthquake Emergency MUDE", because consideration had to be made both for the need to standardise the procedure across

[14] Parts of production and trade premises can also be included in the MUDE system, if they are part of the same structural unit as housing units for which funding is applied for. The same applies for brick-built farm buildings (e.g. stables built according to older methods, often annexed to the farmhouses). The majority of the production activity reconstruction is however managed through another procedure called Sfinge.

the territory and the awareness that the absolute stakeholders of the procedure had to be the municipalities, delegated to manage building permits. Finally, in terms of training and awareness raising among the staff involved, it is worth remembering that many figures revolve around the MUDE procedure: the application filer[15], the designer who manages it, the municipal technicians, the credit institutions paying out the funding, the works contractor (which can be only one company). There are also other "passive" players in the MUDE: the Inland Revenue, which assesses the impact of tax credits granted by the Cassa Depositi e Prestiti on the funding, or the Procure (district attorneys) who monitor the reconstruction and investigate any suspect cases. To manage this complexity, the general approach adopted by the Commissioner was to involve the system of local autonomies through *governance* practices, first of all organised by the institutional Committees composed of the presidents of the provinces and the mayors of the municipalities involved: this involvement allowed decisions to be taken, working together in the implementation of policies in the post-earthquake phase (and therefore also for the part of reconstruction managed via MUDE). Alongside the institutional committees, training and discussion sessions were organised for the staff who had to concretely work on the infrastructure: the municipal technicians, staff trained specifically to manage the needs of every municipality, professionals (and their associations). The objective was to tackle the many criticalities which emerged during the process, effectively integrating the platform that was being engineered.

The Earthquake Emergency MUDE in deed: procedural aspects

It is clear that the funding application process with widespread responsibilities held by a range of stakeholders is very complex. Basically, the mechanism works like a normal building permit management procedure, in which the designer, on behalf of the recipient, completes the application with the data concerning the building (including the sworn technical report certifying the cause-effect of the earthquake/damage) and submits it to the municipality.

The municipalities are one of the key stakeholders. They have the main task of implementing the *inputs* to manage the MUDE procedure. First of all, this meant implementing the computer infrastructure: it meant training staff for the

[15] The filer of the funding application does not always coincide with the owner of the building to be reconstructed. In the case of condominiums, for example, the application must be filed by a single person, representing the interests of all owners.

purpose, in many cases temporary staff hired by the municipalities according to the provisions of the regional orders. The municipalities manage the back office phase of the MUDE (protocolling the application submitted by the designer, application investigation) up to the actual granting of the funding order, i.e. the *output* of the internal process. With the funding order, the contribution authorised to the private party is defined and can be sent to the credit institutions for payment[16]. The administrative procedure incorporated in MUDE is complex due to the quantity and quality of the information the designer has to include in the application, the checks to be carried out by the municipalities and the constant updating of the regulations laid down in the commission orders. In some cases, this led to delays in the investigation phase, with consequent effects on the reconstruction times. In many circumstances, moreover, there was no full integration between the municipal technical offices (with their own management systems) and the new computerised procedure. This led to some processes and activities being performed in parallel, making the system less effective.

On the other side of the MUDE structure are designers, fundamental figures as, on the basis of the proxy mechanism, they have the responsibility for the file and act on behalf of the applicant.

The relationship between the stakeholders of this procedure offers much food for thought on the innovation processes induced by the responses for managing post-earthquake reconstruction. First of all, it is worth investigating the relationship of trust between the applicant and the designer. Application filers are left freedom of choice in selecting the professional designer who manages the file; several times it has been underlined how this could have implications in terms of non-uniformity of the living environment following reconstruction, compared to a context in which such relationship was made to be based less on trust (such as, for example, the alternative of creating a pool of professionals in the regional commission structure to supervise all reconstruction works). Again, the lack of ceiling to the number of files managed by each designer has led to a concentration of many files in the hands of very few designers, which could potentially delay the reconstruction. Also in this case, many stakeholders in the MUDE process, from

[16] Payments which, unless the application filer has already paid out money for reconstruction in advance, do not go directly to him but rather to the companies working on the reconstruction (professionals, contractors, etc.); in most cases, the payments are made according to works progress.

different viewpoints, underline the fact that it would have been more appropriate to establish cooperation among several design firms to create the critical assembly required to manage the technical and organisational innovations in building (from design to construction) which could lead from the reconstruction. Others highlight how the salary for the designers, set by law, is not considered sufficient to make it profitable for larger sized firms or those outside the area to enter the reconstruction market.

It is also worth noting how the technical construction of the "Earthquake Emergency MUDE" platform introduced many details with a view to improving the efficiency of those managing building permit applications. One example is: the automated spreadsheets made available by the municipalities to manage the applications, which can become a tool for analysing the productivity of the processes implemented by each municipality; the digital forms collecting the specific selection of information to use to request the Single Booking Code (CUP), which is essential for applications for public funding, avoiding the manual entry of information in the CUP platform that has already been digitalised in the Earthquake Emergency MUDE platform; the computerised documentation of the mandatory traceability of all bank transfers between the credit institutions, designers and contractors, exploiting the potential introduced by the SEPA (Single Euro Payments Area), the inter-bank payment circuit, and connecting these to the rest of the file data using specific reconciliation strings.

From the "Earthquake Emergency MUDE" to the "Regional Territorial Computer System for Construction"

From the situation described in the previous paragraph, we can see that the primary *output* of the MUDE procedure, i.e. the granting of funding, is only one first aspect of the complexity an innovation like this brings for all stakeholders involved. All the implications of the "Earthquake Emergency MUDE" structure must be monitored and studied with a view to assessing how the *outcome* of the whole process will be achieved, which is at the end of the day the *ultimate objective*: to ensure that the people can return to their homes damaged by the earthquake as soon as possible.

The adoption of the "Earthquake Emergency MUDE" is not a self-contained operation: it is part of a broader design of a series of innovations in the public administration. Thanks to the computerised procedure, much data will be available

on the post-earthquake phase. This aspect will allow us to review the reconstruction itself in snap-shots of the various phases; and to analyse and monitor the reconstruction to make visible the *policy* choices.

4. Conclusions

Three years after the earthquake, the time horizon on which we observe the post-earthquake reconstruction processes is still too short to be able to offer a clear picture of the effective potential of the changes implemented in response to the shock caused by the earthquake. However, from the elements analysed so far, the "Energie Sisma Emilia" project allows us to offer an overview of the dynamics which can be effective in consolidating (or indeed impeding) these changes in cascades of innovation.

The reconstruction processes are analysed in three major areas. The first one concerns the stakeholders involved (workers, families, businesses, non-profit organisations, public administration, local authorities) in their specific positions and roles: not “the workers”, but the specificities emerging from the living and working conditions of people; not “businesses”, but the variegated multitude of experiences, competences, technologies, strategies, financial resources, aptitude for change and risk; not the “large, medium or small municipalities; the more or less manufacturing ones”, but the competences, organisational structures supporting the actions taken to build the new local social fabric or create, for example, the new organisation of the public administration developed as the provinces are abolished. The second one concerns the artefacts contributing to focusing the objectives of various stakeholders in the reconstruction process, such as: schools, digitalisation of building permit applications, health services, but also the communication of the outcomes of the reconstruction. The third one is the analysis of the interactions between different stakeholders.

Finally, we need to consider how the time horizon of the reconstruction processes affects the interactions between stakeholders and artefacts. The reconstruction has established many different processes: material transformation (for example, the building technical specifications), agreement with the local citizens on the direction the local authority's choices will take, creating specific structures to support transformation processes (for example, the planning tools to create public space). The analysis of the transformation processes concerns the social sphere,

the economy and the public administration in the territories affected by the earthquake, as well as the regional administration, which acts as the reference for coordinating local actions. We need therefore on one hand to understand if the reconstruction can keep the step with the expectations of "reconstructing better", and on the other hand, how far the area affected by the earthquake - ultimately a marginal area of the region, far from decision making centres of the regional politics and government - can constitute a laboratory for experimenting transformations on a broader scale of the regional territory. In this sense, the analysis of the reconstruction today and the monitoring of what will happen in the coming years become essential tools for implementing informed public policies, able to steer the territory affected by the earthquake towards more sustainable, innovative and inclusive economic and social development paths than would have happened if they had not been hit by the earthquake. It is with this interpretation that the "Energie Sisma Emilia" project reads the resilience of the social, political and institutional system of the territory hit by the earthquake.

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