

Impact of Coworking on Innovation and Employment

Preliminary Results – Not to be cited nor circulated

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Introduction

The collaborative and creative economy has been in a state of transformation for the past decade (Moriset 2014) and is assumed to be shaping today's global economy towards a post-capitalist set-up (Kostakis and Bauwens, 2014). This transformation, in many cases related to technical change and innovation, has also created a trend towards more decentralized and cooperative work (Spinuzzi 2012; Richardson 2017).

This shift in the nature of work in many cities has been coupled with the emergence of a new type of physical space called a "co-working space". A co-working space hosts freelancers, entrepreneurs, creative professionals and other individuals, who are commonly referred to as "co-workers". There is not yet one conclusive definition for co-working spaces (for a literature review of the different definitions of co-working spaces, see Gandini (2015)). Based on our observations, we prefer to define a co-working space as a collaborative workspace where individuals (mainly entrepreneurs and freelancers) or organizations share utilities (and sometimes specialized equipment) in order to work on creating a certain value added. The space should also offer community networking and support mechanisms.

Co-working spaces provide a hospitable environment where this creative community can jointly kick-start projects, exchange information and knowledge, and access and share new technologies. This is distinct from the commercial concept of "desk-sharing" since the co-workers share, in addition to the space, a certain set of values and belong to the same work community (Leforestier 2009). Co-working spaces are also distinct from other collaborative workplaces that have no economic value added, such as art galleries and symposiums.

The co-working concept emerged in San Francisco in 2005 (Gandini 2015). A year later, the first co-working space in the Middle East and North Africa (MENA) region was established.¹ The phenomenon has since seen a significant rate of growth: it is estimated that as of October 2016, the co-working movement globally had reached 11,300 spaces hosting more than 835,000 co-workers. It is projected to reach 14,000 spaces and more than 1.18 million co-workers by the end of 2017 (Deskmag 2017).

While entrepreneurs in the creative industries are able to work anywhere, the creative sector thrives on collaboration and inspiration. Co-working spaces are, therefore, the ideal driving force for the creative economy since they represent places where creative entrepreneurs can procure projects, exchange ideas, access services and support, and use technology that can aid their growth both individually and collectively (Capdevila 2015). Positioned on the Schumpeter–Nelson–Arrow framework in innovation economics (Potts 2016), co-working spaces are presented as a response to a variety of market failures such as information asymmetry and inefficient allocation of resources. An increasing number of scholars have studied the importance of co-working spaces in transferring new knowledge and bringing it to the market, inspired by the links between entrepreneurship and growth (Audretsch, Keilbach and Lehmann, 2006) as well as the social support and solidarity provided by co-workers (Bianchi, 2016; Gerdenitsch, Scheel, Andorfer and Korunka, 2016).

¹ The Rasheed 22 co-working space was established in 2006 in Cairo, Egypt. Source: Stercken (2015).

In the Arab world, there is no precise measurement of the creative economy. Harabi (2009) estimated it to be around 3 per cent of some Arab countries' GDP and one of the main drivers of economic growth and job creation.² However, there is no clear evidence yet of the impact of co-working spaces on the creative economy's innovation output and job creation in the Arab world.

In February 2014, Hivos,³ an international organization, launched a new programme called Mideast Creatives. With this programme, Hivos aspires to support a more sustainable cultural and creative sector in the Arab region, notably in Egypt, Jordan, Lebanon and Tunisia. This is to be achieved by providing financial support to around 15 co-working spaces, setting up training programmes for entrepreneurs in the aligned industries, and improving their access to finance.

Under the umbrella of this programme, the first attempt to map co-working spaces in the MENA region was conducted in the first half of 2015 (Taha 2015). The study shows that there is a myriad of new co-working spaces in the MENA region: 88 per cent were established between 2011 and 2015, with 30 per cent established in 2015 alone. Results also show a recent hike in the number of such spaces in small non-capital cities, where they are consolidating the social networks of entrepreneurs, social organizations and other innovative, mostly youth-led, initiatives.

This paper presents a rigorous analysis of the effect of co-working spaces on the innovativeness of co-workers and on the number and quality of direct jobs created. It is inspired by the standards of the Donor Committee for Enterprise Development (Fowler and Markel, 2014) and uses the social network analysis⁴ (SNA) methodology in combination with quasi-experimental statistical methods to analyse results from baseline and endline surveys conducted with co-workers from three countries, namely Egypt, Lebanon and Tunisia between 2015 and 2016. Since the aggregate impact of innovation on employment is difficult to measure using microeconomic analysis or macroeconomic empirical studies (Vivarelli 2014), the research investigates, from a meso level, the complex dynamics between innovation and job creation in a knowledge-intensive sector (i.e. the creative industries).

The contribution of the report is twofold. First, it is, to the extent of our knowledge, the first impact assessment of co-working and, more broadly, an innovation-related project in the Arab region that uses SNA. Second, it will contribute to the study of the impact of network characteristics on information and knowledge flows, and their impact on employment, from a meso level rather than the usual micro level of analysis (see e.g. Calvó-Armengol and Jackson, 2004).

The rest of this report is structured as follows: section 2 presents the project and the intervention. Section 3 discusses the literature on co-working spaces and their impact on innovation and job creation. Section 4 describes the design of the study. Section 5 provides a preliminary analysis of the preliminary results. Section 6 concludes the study and discusses the major findings.

² For instance, the number of ICT companies is increasing by 14.16 per cent annually in Egypt.

³ <https://www.hivos.org/>

⁴ SNA methodology is presented in detail in section 4, along with the methodology of the study's strategy.

Section 2: Description of the intervention

The aim of the Mideast Creatives programme is to support young people, and young women in particular, in the MENA region in their quest for individual development and economic independence. To this end, the programme facilitates, among other activities, the creation of co-working spaces for young people aged between 15 and 24. The main aspiration of the programme is the creation of more job opportunities for young people in the region.

The programme aims to foster the expected positive effects of co-working spaces, providing a peer “network” of co-workers, start-ups, etc. and a better reach to potential investors, suppliers and clients either at the individual or the team level (Fabbri and Charue-Duboc, 2013; León, 2015), thereby increasing innovation and employment.

Despite the important role of co-working spaces in regional development and their positive externalities (Research Group Collaborative Spaces 2016), many of these spaces are financially vulnerable and challenged by the significant financial burden they face in terms of running and maintenance costs (Moriset 2014; Research Group Collaborative Spaces 2016).

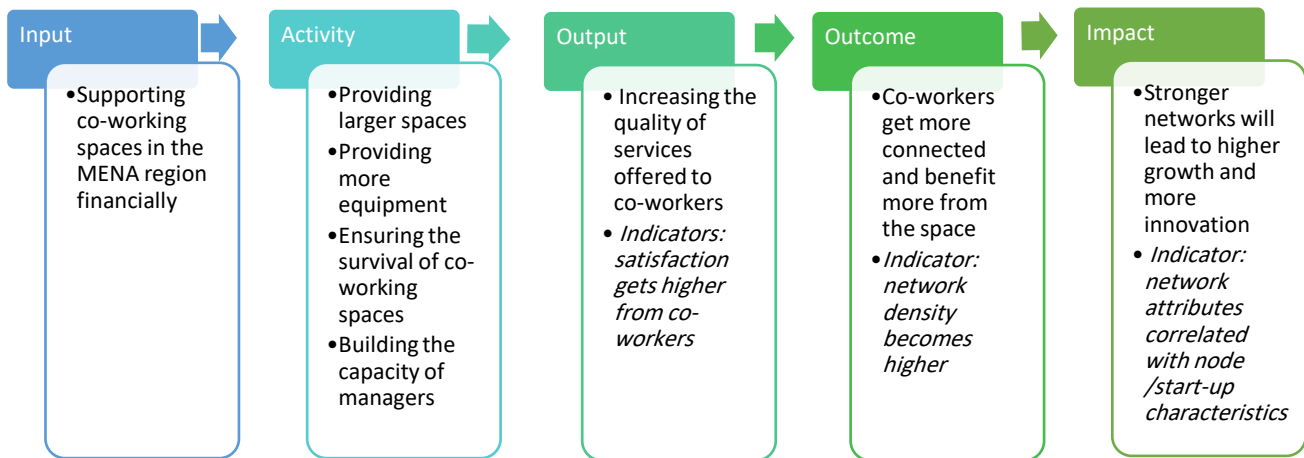
In this context, the Mideast Creatives programme intends to ensure a viable financial model for these spaces, by providing grants to 15 co-working spaces. The spaces were selected based on a competitive call where co-working spaces in the MENA region competed based on four assessment criteria. These were: first, the quality of the implementing team; second, the potential of the space, its community and its social impact; third, the expected impact of the grant on the space and its community; and fourth, the feasibility of the plan to reach financial self-sustainability. The grant scheme offered between €10,000 and €35,000 per space and covered the period from October 2015 to December 2016.

The aim of the grant is to offer managers of the co-working spaces the capacity to extend their services by covering the core operating and managerial costs, including human resources, maintenance, rent, ICT infrastructure, communications, administration, capacity-building training, etc.

By providing financial and capacity-building support to these spaces and their managers, the output of the programme would be for co-working spaces to provide better infrastructure and services. The expected outcome for co-workers is to form stronger networks and ties. These ties could be in the form of (i) social support, (ii) information sharing and (iii) peer-to-peer learning and collaboration. They are all expected to affect co-workers positively in terms of innovativeness and job creation.

The results chain of the programme is illustrated in the graph below.

Figure 1: Results chain of Mideast Creatives



Section 3: Literature review

Despite the relative novelty of the co-working movement, there is a growing recognition of the importance of co-working spaces. Recent years have witnessed a spreading interest among scholars – from a more empirical and, to a lesser extent, theoretical approach – not only in economics but also in psychology and urban studies in understanding this phenomenon. Nevertheless, most of these studies were focused on analysing cases from the developed world. For example, Abe and Uda (2016) carried out a study on 152 co-working spaces in Japan and discovered, among other findings from the correlation analysis, that profit-driven spaces view other spaces as competitors. In a qualitative study, Capdevila (2014) examined the dynamics of innovation involving co-working spaces in Barcelona and found that co-working spaces, through their managers, have an influence in facilitating collaborative practices among co-workers. Gerdenitsch, Scheel, Andorfer and Korunka (2016) found a positive contribution of co-working spaces in Austria to the social support provided to independent professionals. And Parrino (2015) observed an important role of organizational and social proximity in stimulating knowledge flows among co-workers, while controlling for geographical proximity. Other studies presented a broader framework of the role of co-working spaces in the city-level innovation ecosystem (Moriset, 2014; Mulas, Mingos and Applebaum, 2015; Research Group Collaborative Spaces, 2016).

Compared with the wide literature of impact assessment studies on industrial clusters (see Schmiedeberg (2010) for an overview), very little research has assessed the impact of co-working spaces specifically on innovation and job creation, especially in the developing world. This is despite the great similarity between industrial clusters and co-working spaces. Capdevila (2013) even described co-working spaces as *microclusters* since the knowledge and innovation dynamics within them are similar to those referred to in the literature on industrial clusters.

Following this line of thought, several studies on industrial clusters have focused on assessing their impact on innovation and employment generation. However, the empirical findings were not necessarily conclusive in this regard (Udell 1990; Tamasay 2007; Amezcua 2010), notably due to various methodological difficulties in using traditional evaluation methods (Cheng and Schaffer, 2011; Giuliani, Maffioli, Pacheco, Pietrobelli and Stucchi, 2013).

Therefore, in order to fill empirical and methodological gaps, this study will use SNA to capture the interactions and collaborations among different co-workers that are core to the value added by co-working.

SNA will provide a better theoretical understanding of the role of a start-up in the network and its behaviour in terms of introducing a new product or process innovation and recruiting a new employee. According to Aldrich and Ruef's (2006) evolutionary perspective, start-ups first seek knowledge to identify innovative products and business ideas using all the available and accessible resources (including human resources) in their environment. However, the results of this behaviour depend on how close the start-up is to these sources of knowledge. When a start-up lacks such *closeness*, it overcomes this barrier by relying on talent from outside its innovation hub (e.g. full- or part-time employees, volunteers or interns, family members with below market wages, etc.). The research can therefore hypothesize that innovation hubs comprising a dense and homogenous network (i.e. specialized innovation hubs) will have a higher impact on employment growth than networks with a lower level of cross-disciplinary innovativeness.

However, SNA needs to be combined with other quantitative methods for impact evaluation (Schmiedeberg 2010), such as quasi-experimental approaches with constructed controls as suggested by the framework of Oldsman and Hallberg (2002). The following section discusses in detail the methodology suggested by this study.

Section 4: Research questions and identification strategy

The main research questions in this study were formulated on two different levels. First, on the level of the co-worker (micro level), the study analyses the start-up's position and status in the network: do co-working spaces enhance the level of networking and collaboration among start-ups, enabling them to implement cross-sectoral innovations and generate higher levels of economic growth and job creation? Second, it analysis the outcome of such developmental programs on improving the value added of co-workers through innovation and also creating more jobs.

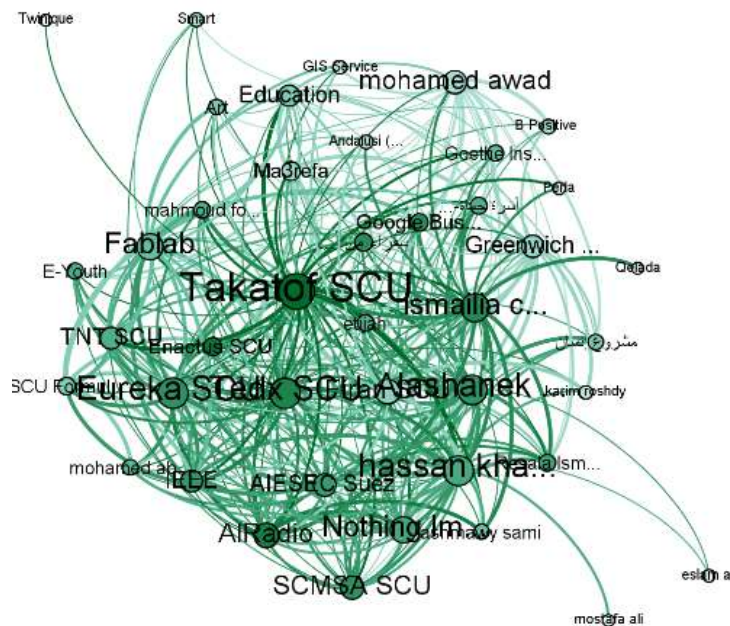
The identification strategy of the study combines two different methodological approaches. As such, this strategy is by itself an attempt to contribute to the innovation and entrepreneurship literature due to its relative novelty, notably in its application to co-working spaces in the MENA region.

First, the study relies on SNA, a methodology that applies graph theory to the analysis of relational data between a set of actors (Hanneman and Riddle, 2005). A social network is composed of actors (or "nodes") – co-workers in the case of this study – and the ties between those nodes. These networks are usually represented in the form of graphs. There are different mathematical formulae used to describe and analyse the structure of the network (e.g. the network's density)

and the position of each of the nodes (e.g. degree centrality,⁵ closeness centrality,⁶ betweenness centrality⁷ and eigenvector centrality⁸).

For instance, the graph in figure 1 represents the social network of one of the grantee co-working spaces in Egypt. Each node⁹ represents a co-worker (either a representative of an organization or a freelancer), and each tie represents a professional connection between one node and another. The thickness of the tie depends on how valuable each node perceives the importance of the connection to the other node to be. The size of each node depends on its eigenvector centrality and the colour intensity is based on its degree centrality.

Figure 2: SNA of a grantee co-working space in Egypt



⁵ Degree centrality measures the number of ties attached to a node.

⁶ Closeness is a measure of centrality in a network, calculated as the sum of the length of the shortest paths between the node and all other nodes in the graph. Thus the more central a node is, the closer it is to all the other nodes (Bavelas 1950).

⁷ Betweenness centrality is the fraction of shortest paths between node pairs that pass through the node of interest (Newman 2007).

⁸ Eigenvector centrality accords each node a centrality that depends both on the number and the quality of its connections. Source: ibid.

⁹ The SNA and nodes' labels were kept anonymous as per the agreement with the interviewees and programme managers.

One of the intervention's main objectives is the strengthening of the network of the co-working spaces and the level of collaboration among the co-workers. To capture the development of the relative position of each of the co-workers in their social network, the study will use a dynamic SNA method. This method was previously used to overcome the trade-offs between the qualitative and quantitative approaches used to assess the effects of business incubator development programmes (Aragon, Aranguren, Diez, Iturrioz and Wilson, 2014; Schmiedeberg, 2010).

Another goal of the study is to assess the causal impact of co-working spaces on young entrepreneurs, their networks and businesses. To this end, it is necessary to construct a credible counterfactual to estimate through a control group what would have happened to young entrepreneurs had they not joined a co-working space, or had joined a different co-working space.

Therefore, after analysing the different determinants of innovation and growth given the co-workers position in their network, the paper will apply a regression adjustment (RA) to analyse the average treatment effect (ATE) from observational data.

The study includes young entrepreneurs from co-working spaces supported by Hivos (the "treatment group") as well as those from co-working spaces not supported by Hivos ("Control Group 1"). In addition, the sample includes a number of young entrepreneurs who do not use the services of a co-working space ("Control Group 2").

Overall, the study combines SNA with a quantitative impact evaluation under an integrated approach inspired by the framework suggested by Giuliani and Pietrobelli (2011).¹⁰ In addition, the above-mentioned quantitative methods are complemented by quarterly qualitative interviews with each of the managers of the co-working spaces.

Figure 3: Treatment and Control Groups

Treated group

- Young people and entrepreneurs using the grantee co-working spaces

Control Group 1

- Young people and entrepreneurs using other collaborative spaces (not given a grant by Hivos). This group was mainly selected based on the location of the collaborative space as well as the type of entrepreneurs using it.

Control Group 2

- Young entrepreneurs not being hosted in any collaborative space.

¹⁰ According to Giuliani and Pietrobelli (2011), "Social network analysis has indeed a very important role to play in impact assessment analysis as it generates highly valuable quantitative network indicators both at the level of the firm (or other relevant unit of analysis) as well as at the cluster level, which can be used in econometric estimations of impact assessment".

Sample size and data collection methods

Both baseline and follow-up field researches were conducted in collaboration with a team of local enumerators (one per country) in early 2016 and 2017, respectively.

The ideal data gathering method would have been to cover the whole population of start-ups, entrepreneurs and initiatives located in the surveyed co-working spaces in order to map the full network using the roster-recall methodology, which ensures the coverage of a large number of linkages within a set of network actors (Henry, Lubell and McCoy, 2012). However, the authors have had taken a random-sampling approach of the network while the questionnaire covered all relational possibilities by asking the sampled nodes about their connections with all the elements of the network. Such respondent-driven sampling was inspired by the work of Salganik and Heckathorn (2004) and James O'Malley and Marsden (2009).

This approach was also adequate given the time and cost constraints in the data collection from the field. However, there have been some challenges in collecting the data in the control groups, as discussed in the section on limitations.

In addition, the survey included data capturing the direct and indirect effects of the programme on job creation, income generation and the scalability of running businesses.

The baseline survey was conducted between December 2015 and May 2016 on more than 120 co-workers in the grantee spaces (the treatment group), other non-grantee spaces (Control Group 1) and creative entrepreneurs not hosted in any spaces (Control Group 2) in the four countries. This distribution is shown in table 1.

Table 1: Distribution of sample observations

Country	Study Group	Name of Space	Number of Observations in Sample		Total Number of Coworkers Identified	
			Baseline	Follow-up [†]	Early 2016	Early 2017
Egypt	Treatment (Members of Hivos CWS)	Boulevard*	1	-	-	-
		Cloudspace	11	19	21	24
		EI-Makan	8	9	19	33
		M3mal	8	14	27	39
	Control 1 (Member of non-grantee CWS)	Mok3b	24	22	27	42
		A'lam Mowazi	5	-	-	-
		Tashabeek	4	2	-	-
Control 2 (Not member of any CWS)		8	3	-	-	
Lebanon	Treatment (Members of Hivos CWS)	Neopreneur	6	4	-	12
		Beit Waraq	-	3	-	8
		Shift	4	1	-	6
	Control 1 (Member of non-grantee CWS)	Al Kindy	6	-	-	8
		Aleph B	4	-	-	-
Control 2 (Not member of any CWS)		5	-	-	-	
Jordan	Treatment (Members of Hivos CWS)	Leaders of Tomorrow	1	-	-	-

	Control 1 (Member of non-grantee CWS)	Tammei	1	Closed		
	Control 2 (Not member of any CWS)		2	-		
	Treatment (Members of Hivos CWS)	ELSPACE	3	10	5	20
		LANGARE	5	10	7	17
		maison d'image	2	-	2	4
Tunisia	Control 1 (Member of non-grantee CWS)	creativa	3	-		
		LABESS	1	Closed		
		Startup Haus	3	-		
	Control 2 (Not member of any CWS)		5	-		

* Grant was revoked

† Other observations will feed in as the data collection is ongoing

The analysis also includes data from the structured interviews conducted with the co-working space managers. The study also used data gathered during the initial call for grants.

To answer the research questions, a number of key variables were identified to capture the results chain:

The quality of co-working services: this is expressed by an analysis of quantitative indicators for the level of co-workers' satisfaction with their own co-working space. Namely the level the coworking have expressed in the change of the level of their happiness (*Happy*), creativity (*Creative*) and productivity (*Productive*) since joining the space.

Node-level network indicators: using node-level network indicators, the study assesses the extent to which the position of the co-workers have relatively changed over the span of the year span. These indicators are namely,

- Inward degree centrality (*indegree*) measuring the number of directed ties to the node *i*;
- Closeness Centrality (*Closeness*) measuring the mean length between node *i* to every other node. This indicator is used in network theory to explain the flow of information or innovation diffusion from its source to other nodes in the network;
- Betweenness Centrality (*Betweenness*) measuring the fraction of all paths between other nodes that the node *i* falls on;
- Eigenvalue Centrality (*Eigenvalue*) measuring the influence and power of the node *i* in its network as it captures the importance of the nodes it is connected to.
- Local Clustering Coefficient (*Clustering*) is the measure how close a node *i* and its neighbours tend to be complete network.

Innovation: using the definitions of the Oslo Manual (OECD 2005), the study focuses on (1) product innovation (*Prod*) which is defined as a new or significantly improved product introduced by the organization in the past year, and (2) process innovation (*Proc*) which is any new production method introduced by the organization in the past year. The dataset also includes the level of novelty (*Novelty*) of the innovation (e.g. local, national and international) and whether it was developed in collaboration with an external entity either for product or process innovation (*ProdCollab* & *ProcCollab*, respectively).

Employment: employment growth is measured by the prospects of the co-worker to hire grow their team in the following 12 months of the time of the interview. In addition, other indicators were collected (e.g. full-time versus part-time employees (*Full & Part*, respectively), number of hired employees from the same co-working space (*Hired*), etc.). Other indicators are also captured, such as level of education and average age of employees.

Section 5: Limitations of study design

Despite the novelty of its methodology and design, the study has faced a number of limitations in terms of internal and external validity.

Internal validity

Non-randomness

The study could not be designed as a randomized controlled trial as co-working spaces that received a grant from Mideast Creatives were preselected through a competitive assessment and a rigorous application process. In addition, it seems plausible that the entrepreneurs' choice of co-working space (or the choice not to join a co-working space) depends on underlying (observable and non-observable) characteristics, some of which might be associated with outcome variables of interest (Wu 2014).

Small sample

The sample size is relatively small due to an inability to obtain a larger control group sample in some small cities. This was because the co-working spaces in these cities were already attracting most of the local creative entrepreneurs, and it was very challenging to find a representative creative entrepreneur who did not belong to the community of any co-working space. However, the tests conducted on the treatment and control groups showed that statistical significance can be ensured when comparing these groups.

The number of observations in Jordan is very small due to the challenges faced in implementing the project there; this is discussed in detail in the country-specific analysis.

High level of attrition

Many measures were taken to minimize the risk of attrition including the collection of a detailed tracking module with the contact information, social media accounts and other details. Other contacts of their frequent collaborators were also included in the survey, to ensure a high response rate in the endline survey. In addition, the team has shared a descriptive report with the coworkers who participated in the baseline survey in order to encourage them to take part in the second round of the survey.

However, given the fact that participants in the control group did not find much incentives in participating in the survey, notably in the follow-up wave, the participation level from control group was very low.

Spillovers

Spillovers between entrepreneurs in the programme are expected, especially in terms of knowledge spillovers. As we are interested in such effects, along with the other impacts of co-working on the network (trust building, cross-collaboration, etc.), the attributions made by

analysing the position of each entrepreneur within the social network of the ecosystem (e.g. their degree of centrality, betweenness, etc.) is be considered as a control of the spillover effects of externalities. In addition, in some cases a displacement effect can take place (e.g. entrepreneurs moving from the control co-working space to the treatment co-working space). Such effects will be treated (inspired by the impact evaluation by Castillo et al. (2014) of an innovation programme in Argentina) using labour mobility as the source of spillovers.

External validity

Given that this study has been conducted in four different countries, with as much harmonization as possible, the concluding results provide a clear insight into the potential differences in terms of policy/institutional settings.

In addition to the baseline and endline surveys, a mixed method approach was used for the purpose of achieving triangulation, complementarity, development, initiation and expansion (Rocco, Bliss, Gallagher and Pérez-Prado, 2003). This was achieved by combining quantitative analysis with SNA and qualitative evaluation approaches (focus groups, participatory evaluation, etc.).

Triangulation was necessary to increase a study’s external validity and interpretability. Accordingly, on a quarterly basis, local researchers have conducted expert interviews, focus groups and participatory research with communities of users, carrying out semi-structured group interviews based on guiding interests.

The aim of such mixed methods is to understand the “why” behind the observed impacts on the treatment and control groups, as well as to validate any interpretations.

Section 6: Results

Coworking Intensity and Network Position

By analysing the above table, we have identified a number of determinants of characterises of the co-worker position within its own network, while controlling for a number of idiosyncratic variables, namely: legal status of the organization, coworking space affiliation of the co-worker and a dummy variable capturing whether or not the co-worker is self-funded.

Table 2: Determinants of Co-worker’s Position within the Network

	(1) Connectiveness Determinants	(2) Eigenvalue Centrality	(3) In-degrees Centrality	(4) Clustering Centrality
hoursperweek	0.371** (0.176)	0.000924 (0.00110)	0.116** (0.0460)	-0.00220* (0.00113)
team	0.121*** (0.0407)	0.000287 (0.000253)	0.0306*** (0.0106)	-0.000447* (0.000260)
Process Innovation <i>Imitation</i>	-6.161 (8.621)	-0.0975* (0.0537)	-4.762** (2.251)	0.0728 (0.0551)

<i>Internal</i>	10.52** (5.020)	0.0318 (0.0312)	2.143 (1.311)	-0.0246 (0.0321)
<i>Domestic Partner</i>	39.48** (16.74)	0.0285 (0.104)	2.949 (4.370)	-0.0159 (0.107)
<i>Foreign Partner</i>	1.686 (13.03)	-0.00133 (0.0811)	0.734 (3.403)	-0.152* (0.0832)
Selffinanced	-9.769* (5.335)	-0.108*** (0.0332)	-4.347*** (1.393)	0.0588* (0.0341)
_cons	-1.814 (7.126)	0.0147 (0.0443)	5.549*** (1.860)	0.475*** (0.0455)
R ²	0.368	0.741	0.596	0.593
N	123	123	123	123

Coefficients; Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.01

As a dependent variable, we captured the quality of the co-worker's position using three different indicators: betweenness, local clustering coefficient, and the in-degrees as explained in the previous section. We can summarize the results of the determinants as follows:

Usage intensity

The results showed a significant level of positive correlation between the number of hours spent on a weekly basis by the organization and its betweenness and in-degrees. This is not surprising since the more the co-workers are operating from the coworking space, the higher is their probability to get connected to other co-workers. However, the impact was negative on the clustering coefficient possibly due the high number of individual freelancers and trainers who often work from the coworking space for a short period but on a regular basis and they usually get cluster with each other faster.

Size of the team

The larger the team in the coworking space, the higher the effect will be on their betweenness and in-degree centrality. However, it will have a negative effect on its clustering coefficient for the same reason mentioned above.

Financial independency

Being self-financed would lead the co-worker to have less intention to create new connections and share resources with other coworkers. Therefore, it has a negative effect on the betweenness, eigenvalue centrality and the in-degree centrality, while it has a positive effect on the clustering coefficient.

Collaboration in developing new production process

While process innovation is not itself a determinant affecting the connectivity of the co-worker, oppositely to the type of collaboration. For example, if the co-workers are developing new production process internally or in collaboration with other domestic partners, the level of betweenness centrality increases by 10 to 40 units respectively.

For further analysis on the impact of the abovementioned network indicators and to minimize the risk of endogeneity due to the simultaneity of the coworker position and its performance, we decided to adopt a Conditional mixed-process model (CMP) as suggested by Roodman (2011).

Effect of the co-worker position in the network on its innovativeness

Using a CMP model to explore the effect of the network position of the coworker on its performance on product innovation, we found that the effect of the position of the coworker depends highly on the quality of the interaction it has within the coworking space.

Betweenness

As shown in the table of Annex 1, the betweenness centrality is significantly positively correlated with the probability to innovation, in a persistent way across the four specification. Coworkers who are connected to different clusters of other coworkers usually are considered as “gatekeepers”. They are in an adequate proximity to gather and combine different ideas and information and, accordingly, introduce new goods or services to their market (Boschma 2005).

Clustering

In the same line of thought, a high coefficient of clustering may lead to being “locked-in” and therefore has a direct and significant negative effect of its probability to innovate since there is no enough sources for new ideas (Tripl and Toedtling 1998; Bogliacino et al. 2012).

Creativity and Clustering

Surprisingly, the level of change in creativity experienced due to coworking has no direct effects on product innovation. Nevertheless, by interacting the creativity index with the clustering coefficient the direct effect of creativity becomes significantly negative and the interaction term has a positive significant effect on the probability to innovate. The direct negative effect shows the insufficiency of creativity to innovate within a coworking space environment. For example, Wu et al. (2016) suggested, institutional trust coupled with knowledge sharing would increase the level of team creativity.

Trust, Creativity and Clustering

Similarly, the trust and feeling of safety inside the space has no direct effect on product innovation. While interacting the three explanatory variables trust, creativity and clustering, results in the third specification of Annex 1 showed a significant and positive coefficient on product innovation. The more institutional trust is coupled creativity and efficient knowledge sharing, the more probability the team has to innovate.

Effect of clustering on growth

In the second equation of the Annex 1, and while controlling for the coworking space affiliation of the coworker, neither the clustering coefficient nor the number of full-time employees has no effect on the prospects to changing team size.

After interacting both variables, we found out a negative and significant correlation of the interaction between on the dependent variable. This result relates to concept of resource sharing and mutual solidarity among coworkers within coworking spaces where many of the coworkers share their own time and resources (Bianchi 2016b); therefore they might not need to recruit additional hires.

Treatment effect of the program output

Beyond the co-worker-level effects of its network position on its innovativeness, we have compared those who have been coworking in the coworking spaces funded by the program and those who remained in the other coworking spaces using the average treatment effect method assuming that the intervention has been randomly assigned to the coworkers.

These average treatment effects resulted from the comparison of the treated co-workers with the counterfactual case (Control1 Group) presents us the contrafactual case of the effect of the program if the treated group wouldn't have been coworking from the granted spaces as shown in Table 3.

Table 3: Determinants of Co-worker's Position within the Network

	(1) Product Innovation	(2) Tream Growth
ATE		
Treatment vs Control1	0.233* (0.122)	0.120 (0.192)
Estimated potential-outcome means		
Treatment = 0	0.336*** (0.112)	2.377*** (0.171)
<i>N</i>	112	115

Coefficients; Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Table 3 shows that the effect of the program is significantly positive on the probability of the co-workers to innovate while it is positive but not statistically significant when it comes to team growth.

Given the limitations of the dataset and the lack of observations in Control Group II, we couldn't calculate thoroughly the general effect of coworking spaces on other working environment.

Concluding Recommendations

This study on coworking spaces in the MENA took the MideastCreatives (MEC) Project on Collaborative Spaces as an example to assess the impact of coworking on innovation and job creation, notably in the creative industry. It has also highlighted the main determinants of the connectiveness between co-workers in order to have better outcomes regarding innovation and job creation.

Considering the paper's insights, there are a number of recommended actions to be taken in any measures related to co-working spaces in the MENA region and, more specifically, during the

implementation of any relevant programme targeting a network creation among co-workers, to attain the main objectives of the project.

The support for the infrastructure of the co-working spaces by the programme, along with ensuring their financial sustainability, is of great importance. Such infrastructure needs to provide the necessary conditions to encourage more creative collaboration among co-workers as well as trust-building activities. Results from the paper have shown that having a close cluster of co-workers is not sufficient as long as it is not built on trust and efficient informational flow.

Accordingly, there is a need to stimulate more cross-sectoral collaboration, given that co-working spaces are one of the few places where cross-disciplinary innovation can occur spontaneously.

Our overall observations so far recognize the significance of the intervention by Mideast Creatives in supporting the co-working spaces, given their potential impact on innovation and job creation. Meanwhile, the spaces have an important pioneering role in pushing the values of creativity and collaboration, both of which are necessary for local economic development and job creation, especially in small non-capital cities.

The evaluation team highly recommend the extension of this programme while taking the abovementioned challenges and recommendations into the utmost consideration of any future implementation.

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Annex 1

	(1) Basic Specification - No Interactions	(2) Interaction between Creativity and Clustering	(3) Interaction between Creativity, Clustering and Trust	(4) Specification (3) + Interacting Full Time with Clustering
Dependent Variable = prod				
Creative	-0.0336 (0.0343)	-0.173** (0.0733)	0.892* (0.463)	0.896* (0.469)
Clustering	-1.352** (0.644)	-3.656*** (1.213)	7.426 (5.225)	7.548 (5.305)
trust	0.00709 (0.0381)	-0.00135 (0.0293)	0.691** (0.320)	0.698** (0.324)
Betweenness	0.0223*** (0.00630)	0.0253*** (0.00579)	0.0256*** (0.00525)	0.0254*** (0.00528)
TeamSize	-0.00159 (0.00230)	-0.00192 (0.00220)	-0.00148 (0.00216)	-0.00135 (0.00217)
Creative*Clustering		0.341** (0.160)	-1.709* (0.940)	-1.706* (0.950)
Creative*Trust			-0.121** (0.0536)	-0.122** (0.0540)
Clustering*Trust			-1.299** (0.618)	-1.314** (0.627)
Creative*Clustering*Trust			0.234** (0.109)	0.235** (0.110)
_cons	0.420 (0.477)	1.407** (0.646)	-4.569* (2.707)	-4.639* (2.748)
Dependent Variable = Prospection for increasing the Team Size				
Clustering	-0.780 (1.161)	-0.845 (1.190)	-0.898 (1.215)	-0.539 (1.196)
Full	0.00762 (0.00477)	0.00758 (0.00476)	0.00763 (0.00475)	0.0271*** (0.0101)
Clustering*Full				-0.0517** (0.0237)
_cons	2.994*** (0.515)	3.008*** (0.517)	3.017*** (0.522)	2.817*** (0.518)
Dependent Variable = Betweenness				
Hours	0.505*** (0.136)	0.490*** (0.133)	0.480*** (0.131)	0.484*** (0.131)
TeamSize	0.131*** (0.0365)	0.131*** (0.0364)	0.132*** (0.0364)	0.130*** (0.0364)
Process Collaboration				
<i>Imitation</i>	0.526 (5.761)	0.763 (4.918)	0.489 (4.647)	0.460 (4.685)
<i>Internal</i>	6.653* (3.597)	5.254* (3.129)	3.836 (2.848)	3.922 (2.890)
<i>Domestic Partner</i>	43.19***	42.05***	42.86***	43.21***

	(13.45)	(13.09)	(12.38)	(12.39)
<i>Foreign Partner</i>	10.99	11.33	8.486	8.424
	(8.966)	(8.113)	(8.098)	(8.147)
SelfFunded	-6.457*	-4.677	-4.948	-5.064
	(3.780)	(3.430)	(3.192)	(3.233)
_cons	0.725	2.963	3.953	3.874
	(5.725)	(5.566)	(5.264)	(5.277)
Dependent Variable = Clustering Coefficient				
hoursperweek	-0.00272***	-0.00268***	-0.00266***	-0.00267***
	(0.00100)	(0.000993)	(0.000985)	(0.000984)
TeamSize	-0.000483**	-0.000485**	-0.000488**	-0.000472**
	(0.000236)	(0.000236)	(0.000235)	(0.000238)
Process Collaboration				
<i>Imitation</i>	0.0519	0.0511	0.0511	0.0513
	(0.0478)	(0.0466)	(0.0458)	(0.0458)
<i>Internal</i>	-0.0111	-0.00638	-0.000822	-0.00179
	(0.0281)	(0.0275)	(0.0270)	(0.0271)
<i>Domestic Partner</i>	-0.0327	-0.0297	-0.0330	-0.0345
	(0.0954)	(0.0947)	(0.0931)	(0.0932)
<i>Foreign Partner</i>	-0.179**	-0.179**	-0.170**	-0.171**
	(0.0737)	(0.0727)	(0.0717)	(0.0713)
SelfFunded	0.0465	0.0405	0.0405	0.0422
	(0.0301)	(0.0297)	(0.0290)	(0.0288)
_cons	0.468***	0.460***	0.456***	0.456***
	(0.0408)	(0.0407)	(0.0400)	(0.0400)
Insig_2	-0.480***	-0.477***	-0.475***	-0.495***
_cons	(0.0767)	(0.0796)	(0.0821)	(0.0824)
Insig_3	3.068***	3.082***	3.086***	3.085***
_cons	(0.0667)	(0.0678)	(0.0672)	(0.0671)
Insig_4	-2.007***	-2.002***	-2.000***	-2.001***
_cons	(0.0649)	(0.0654)	(0.0656)	(0.0655)
atanhrho_12	0.177	0.191	0.224	0.220
_cons	(0.151)	(0.157)	(0.166)	(0.165)
atanhrho_13	-1.239***	-1.517***	-1.618***	-1.607***
_cons	(0.290)	(0.332)	(0.307)	(0.308)
atanhrho_14	0.484***	0.536***	0.580***	0.575***
_cons	(0.156)	(0.152)	(0.148)	(0.149)
atanhrho_23	-0.152	-0.159	-0.166	-0.175
_cons	(0.121)	(0.124)	(0.127)	(0.126)
atanhrho_24	0.166	0.182	0.195	0.198
_cons	(0.261)	(0.268)	(0.273)	(0.272)
atanhrho_34	-0.353***	-0.363***	-0.368***	-0.367***
_cons	(0.0928)	(0.0940)	(0.0938)	(0.0938)
atanhrho_12	228.6	232.6	240.5	245.1
df_m	51	52	55	56
N	123	123	123	123