INTRODUCTION

Current evaluation frameworks in research policy were designed to address: 1) life and natural sciences, 2) global research communities, and; 3) scientific impact. This is problematic, as they do not adapt well to SSH scholarship, to local interests, or to consider broader societal impacts. Moreover, their focus on outputs, implicitly assumes a linear relation between the activity (research) and the expected result (publication). This linear perspective is particularly problematic to the SSH areas as they can address different audiences (Nederhof 2006). But many of the ‘impacts’ SSH activity may have in society are due to multiple factors (problem of attribution) and are of a secondary nature that is, the outcome may not be traceable to any single given output but to cascading effects (Upton et al. 2014). Here we propose a network approach for identifying societal contributions in local contexts. The goal of this approach is not to develop indicators for benchmarking, but to map interactions for strategic assessment. The absolute “value” or “weight” of the interactions cannot be captured, but we hope the method can identify the hot spots where they are taking place.

This paper discusses three different evaluation frameworks and proposes a methodology to operationalize them and capture societal interactions between social sciences and humanities (SSH) researchers and their local context. Many countries are putting an increasing emphasis on the societal impact discourse when assessing research performance. They are calling for evidences of societal impact, urging researchers to engage on social outreach and public engagement. Citizen science (Irwin 1995), science for the people (Layton 1973), mode 2 science and society (Nowotny et al. 2001), public value of science (Brewer 2013) or societal impact (Spaapen & Drooge 2011) are just some examples of the concepts used indistinctively to relate to the co-evolving interactions that develop between society and science.
CONCEPTUAL FRAMEWORKS
To avoid linear “impact” indicators, we suggest the application of alternative evaluation frameworks which consider process-based indicators. Because output-based approaches consider the relation between the activity and the outcome to be linear, it ties researchers to take an expected course of action, intruding in many cases in their communication patterns (Fuchs 2014). A process-based approach encourages researchers towards social engagement without tying them to a closed set of outputs. This means a shift from an ‘impact’ discourse to promoting ‘productive interactions’ between academics and non-academics (Molas-Gallart & Tang 2011).

Here we consider three frameworks which, to our understanding, define and describe in a consistent manner process-based interactions, but have so far failed at proposing a scalable and quantitative methodology to assess them. These frameworks intend to overcome problems raised when trying to assess scholarly performance and activities beyond scientific impact. The first approach we refer to is the ‘third stream metrics’ (Molas-Gallart et al. 2002) where they differentiate between activities and capabilities of universities. Capabilities are defined as of two types: physical facilities and knowledge capabilities. Based on this key differentiation a set of indicators is developed associated to each aspect. The second framework is based on the ‘productive interactions’ concept (Spaapen & van Drooge 2011), which adopts a process-based perspective. Its originality is due to explicitly driving away from an ‘impact’ discourse (understood as the effect of research in society).

If we look at the ‘third stream metrics’ framework and the ‘productive interactions’ concept in terms of networks, we could make the following analogy. Capabilities represent nodes; and activities, defined as productive interactions, are the edges of a network by which academics and institutions interact and exchange knowledge with non-academics. Here is where the third framework, the ‘knowledge value’ framework (Rogers & Bozeman 2001), becomes relevant. This framework aims at defining the unit of analysis that should be used for evaluation instead of R&D programs. They present two core concepts: knowledge value collectives (KVC) and knowledge value alliances (KVA). In short, KVC is defined as the set of individuals who share a common knowledge base, while KVA is defined as a subset of a KVC where individuals are interacting with each other.

EXPECTED METHODOLOGICAL CONTRIBUTION
In our understanding, the three proposals referred to above describe the research process and collectives as interactions, flows and connections, but fail to recognize the network approach as a way of implementing them empirically. Instead, they rely on unidimensional indicators. Indeed, it was Harrison White the one to first relate peoples’ activities with their interactions and the importance of context on the shaping of such interactions (Watts 2004). Visualizing societal contributions as processes instead of societal impact as outcomes presents important advantages for research evaluation practices. It allows policy makers to take strategic action and to try to anticipate the desired impact (i.e., offering ‘institutional’ support or promoting universities’ role in society). Also networks of people and institutions can be seen as forms of embodied cultural and social capital. Due to the richness of the connections and the heterogeneity of its different actors, they have a value by themselves which should be considered when assessing the role of universities in local development.
To capture such interactions, we propose the use of social media and web-link analysis to identify interactions between academics and local stakeholders. We consider that the power of these tools is not so much on understanding their meaning as ‘acts’ to develop impact or visibility metrics whenever a mention to a research article is made (Haustein et al. 2015), but as proxies for personal interactions. These networks are what Rogers & Bozeman (2001) refer to as KVA. We hypothesize that such alliances may or may not be established within a KVC. We argue that both types of alliances may be established. This methodology may benefit SSH areas, due to the direct and informal nature of relations between scholars from these fields and non-academics (Olmos-Peñuela et al. 2014). The strength of such approach is based on its potential to monitor unstructured interactions, as well as those which are the result of a specific research action (i.e., an R&D project). Therefore, research policy makers can monitor and better comprehend the process of interactions developed, and also identify other hot spots where productive interactions may well be taking place.

PRELIMINARY RESULTS AND FURTHER STEPS

In order to test our methodology, we will conduct several case studies in different cities of Spain and The Netherlands focusing for each of them on specific events and SSH areas. Here, we show two examples of the types of networks we aim at discovering through our approach. These examples are very preliminary results and should be considered as illustrations of the methodology rather than complete analyses of our case studies.

Figure 1 shows some preliminary results of relations between a sample of spin-offs, music-related and movie-related institutions in the city of Granada. As observed, although interactions through the web are not fully explored in this first approach, we can already capture ties between cultural events and institutions and the university. We also observe the strength of the tie between the city and the university, highlighting its role as an anchor institution for cultural life of the city (Goddard et al. 2014).

In our second test (figure 2) we focus in the case of the city of Valencia and web-links between university and a sample of local associations and cultural events. A complete different picture emerges here. First, we find three components instead of one: one formed by a neighbourhood association and a local association, a second one where the University of Valencia (uv.es) acts as central node connecting a local political association and other associations defending local agriculture, and a third component relating theatre and arts institutions and associations. Second, we observe how three of the four universities analysed (ucv.es, uchceu.es and upv.es) remain as isolated nodes of the network. In this case, the University of Valencia seems to be the only one establishing ties with local bodies, although its role in our network does not seem to be as central as in the former case. Interestingly, local authorities such as the local council (valencia.es) the regional department of culture (culturartsgeneralitat.es) do not play a crucial role either.

Although these examples need further refinement, they offer a good example of the type of interactions we are proposing to capture through our network approach. In this case we have used an out-link analysis between a selected sample of institutional websites without going into much depth in our analyses. Future directions will go into the designing and analysis on the relation between the university and specific events or institutions in the city. Our aim is to go beyond an institutional perspective and make use of Twitter, blogs and Facebook to identify direct personal interactions that may reflect a greater (but also informal) role of
universities in the case of Valencia for instance, than previously noted through our web-link analysis.

Figure 1. Out-link network of the University of Granada and its interactions with other local institutions. Node colours: red > University of Granada and City Council; green > music related festivals and institutions; orange > spin-offs; blue> movie related festivals and institutions. Depth of crawling: 1.

In the case of Twitter data, we expect to encounter a series of challenges derived from the nature of this social media platform. These are the following:

1. Twitter data is retrieved by querying its API, which means that our network will be dependent on such query and we will not know to what extent we are showing a complete picture of the activity we are querying.

2. Because of such difficulty to retrieve and manage complete datasets, we cannot analyse local interactions between academics and non-academics in general, but must focus on specific events. Here we define events as the sociocultural activity or movement of our interest.

3. Due to the size of the network and the informal nature of the platform, nodes representing academics are not self-evident or easily identifiable.

4. It is equally difficult to identify non-academics having an active role in a given activity.

5. Even after having identified non academics and academics, we should be able to establish through the network the level of engagement of these two groups in a given discussion (in our case, related with a given sociocultural local event).
Figure 2. Out-link network of four Valencian universities and their interactions with other local institutions. Node colours: red > universities and local and regional public institutions; green > music related festivals and institutions; orange > social and neighbourhood associations; blue > theatre and arts related associations. Depth of crawling: 1.

However, Twitter has the positive aspect of informing us of different types of ties between nodes, hence links can be established in terms of followers and followees, mentions or retweets. Such distinctions allow us to distinguish between social distance and network paths (Watts, Dodds & Newman, 2002). That is, two dimensions of the network which could allow us to identify 1) potential academics, and 2) potential actors involved in a given event. We define social distance as that related to the acknowledgement two nodes make of each other. Hence, if node A and node B follow each other, we consider them ‘socially’ close to each other. Network paths are defined as those which link two nodes by discussing common topics.

Academic nodes are identified in terms of social distance. This can be done following two possible strategies:

1) We query for a given university’s Twitter account and identify all its followers and followees. We consider academics all those nodes which follow the university and are followed by the university.

2) We identify through Altmetric.com API all Twitter accounts discussing research papers authored by a given university. We then cross these accounts with the university account and consider those nodes to be local and academic. This definition would be more restrictive.

In order to identify network paths between academics and non-academics with regard to a given local sociocultural event, we query the Twitter API in order to retrieve discussions related to such event. Then we locate previously identified academic nodes and analyse
through network centrality measures their role in the discussion and how they relate with non-academic nodes.

**CONCLUDING REMARKS**
The present paper proposes a novel approach for analysing societal contributions of SSH academics to their cities. Although the methodology is not fully implemented, very preliminary results are offered for illustrating its potentialities. This proposal shows a quantitative approach which can be of use for research policy makers. Such methodology is characterized by the following aspects:

1. *Local versus global impact.* It is directed at the contribution academics make to local development, as opposed to traditional indicators such as citation metrics.

2. *Sociocultural impact of academia.* Societal relevance is traditionally considered in socioeconomic terms. Focusing on interactions rather than impact-based indicators offers a wider perspective as to what is considered ‘societal’.

3. *Social networks instead of impact indicators.* As illustrated by the three evaluation frameworks presented above, recent developments in research evaluation are directed at analysing interactions between institutions, academics and other actors (firms, non-academics, society in general). However, they fail at operationalising their proposals in terms of network analysis. Network analysis and mapping have already been proven a powerful tool for research evaluation (Noyons, 2005; Wallace & Rafols, 2015), however they have not yet been applied in the context of societal impact.

4. *Social media as a data source.* Although other studies have analysed societal contributions in SSH, they usually recollect their data either through surveys (Olmos-Peñuela, Castro-Martinez & D’Este, 2014) or interviews (Olmos-Peñuela et al., 2014). Such methods are of limited success for research policy purposes for the following reasons: 1) they are costly in terms of time and money, 2) they are highly dependent on the subject’s capacity to inform fully of their activity, and 3) they are intrusive, intervening with academics’ activities. Using web-link analysis and, specially, Twitter, offers a relatively easy, non-intrusive and ‘decontextualized’ way of retrieving data for analysing informal interactions.

**References**
Brewer, J.D. (2013). *The Public Value of the Social Sciences: An Interpretive Essay.* A&C Black.

Fuchs, M.Ž. (2014). Bibliometrics: Use and abuse in the humanities. Blockmans W., Engwall, L., & Weaire D. (eds) *Bibliometrics. Use and Abuse in the Review of Research Performance*, pp. 107–16. Portland Press: London.

Goddard, J., Coombes, M., Kempton, L., & Vallance, P. (2014). Universities as anchor institutions in cities in a turbulent funding environment: vulnerable institutions and vulnerable places in England. *Cambridge Journal of Regions, Economy and Society*, 7(2), 307–25.

Haustein, S., Bowman, T.D., & Costas, R. (2015). Interpreting ‘altmetrics’: viewing acts on social media through the lens of citation and social theories. *arXiv:1502.05701*. 

This work is licensed under a Creative Commons License: Attribution-NonCommercial-NoDerivatives 4.0 International.
Irwin, A. (1995). *Citizen Science. A Study of People, Expertise and Sustainable Development*. London and New York: Routledge.

Layton, D. (1973). *Science for the People*. London: Allen & Unwin.

Molas-Gallart, J., Salter, A., Patel, P., Scott, A., & Duran, X. (2002). Measuring third stream activities. *Final report to the Russell Group of Universities*. Brighton: SPRU, University of Sussex.

Molas-Gallart, J., & Tang, P. (2011). Tracing ‘productive interactions’ to identify social impacts: an example from the social sciences. *Research Evaluation, 20*(3), 219–26.

Nederhof, A.J. (2006). Bibliometric monitoring of research performance in the Social Sciences and the Humanities: A Review. *Scientometrics, 66*(1), 81–100.

Noyons, C. M. (2005). Science Maps Within a Science Policy Context. In H. F. Moed, W. Glänzel, & U. Schmoch (Eds.), *Handbook of Quantitative Science and Technology Research* (pp. 237–255). Springer Netherlands.

Nowotny, H., Scott, P., & Gibbons, M. (2001). *Re-thinking science: knowledge and the public in an age of uncertainty*. Cambridge: Polity Press.

Olmos-Peñuela, J., Castro-Martínez, E., & D’Este, P. (2014). Knowledge transfer activities in social sciences and humanities: Explaining the interactions of research groups with non-academic agents. *Research Policy, 43*(4), 696-706.

Olmos-Peñuela, J., Molas-Gallart, J., & Castro-Martínez, E. (2014). Informal collaborations between social sciences and humanities researchers and non-academic partners. *Science and Public Policy, 41*(4), 493–506.

Rogers, J.D., & Bozeman, B. (2001). ‘Knowledge Value Alliances’: An Alternative to the R&D Project Focus in Evaluation. *Science, Technology, & Human Values, 26*(1), 23–55.

Spaapen, J., & van Drooge, L. (2011). Introducing ‘productive interactions’ in social impact assessment. *Research Evaluation, 20*(3), 211–8.

Upton, S., Vallance, P., & Goddard, J. (2014). From outcomes to process: evidence for a new approach to research impact assessment. *Research Evaluation, 23*(4), 352–65.

Wallace, M., & Rafols, I. (2015). Research Portfolio Analysis in Science Policy: Moving from Financial Returns to Societal Benefits. *Minerva, 53*(2), 89-115.

Watts, D.J. (2004). *Six degrees: The science of a connected age*. Vintage.

Watts, D.J., Dodds, P.S., & Newman, M.E.J. (2002). Identity and search in social networks. *Science, 296*(5571), 1302-1305.