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# Institutional perspectives in transition: research groups' profiles and embeddedness in organisational and national context

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## Abstract

Research into differentiation and profiling of knowledge producing institutions through the lenses of institutional logics and field embeddedness have proliferated in recent years. By discussing this process in the context of research groups, as those basic units in which knowledge production epistemically and practically takes place, this article offers a contribution to the theoretical discussion on organisational differentiation. Based on a small-N comparative case study of research groups operating in different national and organisational contexts on a single, highly competitive and interdisciplinary applied sciences field, nanosciences, the article proposes research group profiles as heuristic devices to explore both the embeddedness and strategic agency of research groups.

**Keywords** Research groups · Profiles · Institutional logics · Nested organisational fields · Competitive horizons · Key enabling technologies · Nanosciences

## Introduction: the shifting contexts of knowledge producing organisations

The changing contexts of knowledge production (Gibbons et al. 1994; Nowotny et al. 2001; Etzkowitz and Leydesdorff 2000) in developed industrialised societies (Jessop 2004; Brante et al.

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1993; Välimaa et al. 2016; Castells 2000; Rust et al. 2010; Stone 2005) and the arrangements made to foster innovation (Castellacci and Natera 2013; Lundvall 2007; Weber and Rohrer 2012) have been widely discussed. It has been repeatedly argued (Hüther and Krücken 2016; Fumasoli and Huisman 2013; Musselin 2000; Paradeise and Thoening 2013) that the classic triangle of coordination by Burton Clark (1983) no longer adequately represents the multiplicity of operational contexts of higher education. In the context of competitive globalisation and multilevel governance (Austin and Jones 2015; Van Kersbergen and Van Waarden 2004; Hooghe and Marks 2001; De Boer et al. 2007), the idea that all units of the system follow the same logic, and that the differences in the triangle of coordination exist primarily between systems, and not within them, has been contested. Instead, knowledge-producing institutions increasingly differentiate and profile themselves aiming to serve different segments, to produce value for the economy and ultimately to prevail in the competitive global knowledge markets (Fumasoli and Huisman 2013; Gibbons et al. 1994; Guilhon 2004). Many institutions increasingly rely on managerialist approach to do this (de Boer and Huisman 1999; De Boer et al. 2007; Leisyte et al. 2008; Byun 2008; Capano 2011; Stensaker and Fumasoli 2017; Donina and Hasanefendic 2019). Differentiation seems to serve both knowledge producing institutions and their sub-units—research groups—as those basic units in which knowledge production epistemically and practically takes place (Carvalho and Santiago 2016).

In this comparative study, we are interested in finding out how research groups relate to, and constitute the contexts in which they operate. We investigate research groups operating on a single, highly competitive and interdisciplinary applied sciences field, nanosciences, labelled as one of the “key enabling technologies” by the European Commission (2012), indicating the high relevance of the work of these research groups from the perspective of the European Union’s competitiveness policy (Kuhlmann 2001; European Commission 2009, 2012). As universities no longer hold the monopoly of knowledge production (Gibbons et al. 1994; Ziman 1996), we study research groups in multiple knowledge producing institutions in addition to universities: research institutes, technology development centres and companies. Our research groups are located in three relatively small but technologically advanced EU countries, anonymised to protect the identity of the respondents: one Southern European country (SE), another located in Central Europe (CE) and the third one in Northern Europe (NE) and thus could be considered to hold an established, yet somewhat peripheral place in the European sciences arena.

Our comparative study starts from an assumption that multiple comparative contexts, e.g. countries and organisations, bring variation into the research group’s operational environment, while the single research field offers a standardising element in their intellectual epistemic community. Instead of passive adapters to different contexts, we see research groups as actively constructing their own operational context through, for example, their choice of collaborators or construal of their arena of operations, and ask the following research questions: Are the self-understandings of the research groups different in different organisational and country contexts? How do research groups relate to their environments?

We explore the research groups’ self-understandings about their operational context through the ways in which they talk, for example about their mission, orientation towards local, national or global arena, clients and beneficiaries and characteristics pertaining to their collaborations and encountered competition. Resulting from the analysis, we present research group profiles as heuristic devices, allowing for a cross-case comparison, and discuss whether these profiles seem to be linked to the country context or organisational type.

## Theoretical considerations: nested organisational fields and institutional logics

Knowledge producers are variably embedded in geographical fields of action and influence (Marginson and Rhoades 2002; Välimaa and Hoffman 2007; Hoffman et al. 2016; Kosmützky and Ewen 2016; Carvalho and Santiago 2016). This is supported by collaboration and public-private partnerships (Čábelková et al. 2017; Edmondson et al. 2012; Henningsson and Geschwind 2017; Perkmann and Walsh 2007) as well as the policies of collaborative knowledge production with variable funding streams (Cummings et al. 2013; Edmondson et al. 2012).

The institutional logics (Thornton and Ocasio 1999; Thornton et al. 2012) of the organisation in which research groups are embedded influence the way in which they operate. Thus, despite potential convergence of institutional logics in the neoliberal context (Degn et al. 2017; Ocasio and Radoynovska 2016; Paradeise and Thoening 2013) and the simultaneous existence of multiple optional logics (Kraatz and Block 2008), the operational context and the institutional logics of research groups in universities would be qualitatively different from those groups operating in government research institutes (Poti and Reale 2000), and still different from those in companies or other business entities (Ocasio and Radoynovska 2016). Due to the convergence of national higher education policies in Europe (Bloch and Mitterle 2017; Clark 1983; Kauko 2013; Pinheiro et al. 2016; Reale and Seeber 2013), we assume that more similarities exist between universities in different countries (Diogo 2016) than between university and a business entity in a single country (Musselin 2000). However, the contexts in which knowledge-producing organisations are embedded are much more complex than those determined by the organisational type. The most interesting perspective on the complex environments is advanced by Hüther and Krücken's (2016) concept of nested organisational fields, which Hüther and Krücken (2016: 53) argue, allows for "simultaneously explaining homogenisation and differentiation of universities within individual countries" and of the formation of cross-national subgroups of specific types of universities in different countries. Drawing from Scott's (2013: 233) idea of nested interrelated fields, they primarily consider nested organisational fields as comprised of spatial elements, such as global, European and multiple national fields; which, at least at the local level, may be separated or overlapping. The nested field framework is thus "well suited to identifying structural and systemic factors for homogenisation and differentiation among cross-national subgroups" (Hüther and Krücken 2016: 76). National innovation, science and technology policies and reforms or political and administrative structures can also potentially explain the simultaneous isomorphism and differentiation in research groups' *modus operandi* regardless of the organisational or national settings (c.f. Hüther and Krücken, 2016; Bleiklie and Michelsen 2013; Bleikie et al. 2017; Dobbins and Knill 2009; Ramirez and Christensen 2013). This supplements Clark's (1983) notion that evolving and specialising disciplines and research units themselves push for differentiation, while national systems and organisations of knowledge production exert a convergent influence. Based on the work of DiMaggio (1983), Hüther and Krücken (2016: 59) observe that the state is only one source of institutional pressure in organisational fields; besides coercive influence of the state through legislation, governance and funding, also mimetic and normative pressures exist. Also, the converging discourses of globalisation and knowledge society (Nokkala 2016a, 2016b) contribute to institutional convergence, as they constitute taken for granted logics of desired courses for policy and action. Thus, appropriate action is not solely determined by the external operational, e.g. regulatory or competitive environments, but also by the assessment and perceptions of the research groups themselves and their environment;

for example their self-construed competitive horizon, in which they see themselves as local, national or global level actors (Välilmaa and Hoffman 2007). This also tells us that research groups are not only steered by external environments, but they also have a strategic agency (Fumasoli and Huisman 2013; Bleikie et al. 2017), and they actively translate and interpret their operational environments and their own role in it. Thus, in addition to coercive or mimetic isomorphism discussed by neoinstitutionalists (Scott 2013; Diogo et al. 2015) or the institutional logics of Thornton and Ocasio (1999); these internal understandings or construals are important for understanding the strategic action of research groups and the differentiation of their *modus operandi*.

Similarly, inside the institutional paradigm, Paradeise and Thoenig (2013: 191) argue that higher education institutions are “being forced to adopt a unique strategic position with a uniform vision of quality in terms of performance” which position institutions in worldwide rankings as a means of partaking in open competitions. Not conforming with these logics means a costly sentence to higher education institutions, even if this implies or undermines organisational diversity (Fumasoli and Huisman 2013; Paradeise and Thoenig 2013). On this, Fumasoli and Huisman (2013) argue that organisational change is possible through embedded agency and institutional entrepreneurship, affecting their institutional positioning, which consequently might increase or decrease institutional diversity. As higher education institutions respond to environmental demands, opportunities and threats, “they display different degrees of agency: from reacting and adapting to intervening dynamically to modify the context in which they are embedded” (Fumasoli and Huisman 2013: 6). Therefore, we propose that the research groups have an entrepreneurial agency independent of their national and/or organisational context, forming a specific nested organisational field. We see that the agency of research groups is represented by the ways in which they define their competitors, seek their collaborators or construe their primary mission or arenas of action. As all our groups operate on the same broad interdisciplinary field, we do not investigate the disciplinary impact beyond acknowledging that research groups are also embedded in the disciplinary contexts, and thus impacted not only by their organisational context but also by the dynamics of the disciplines themselves (Clark 1983; Becher and Trowler 2001).

Much of the aforementioned discussion on the complexity of differentiation and profiling of knowledge producers focuses on the organizational level of higher education institutions. This paper aims to contribute to the discussion on different responses of knowledge-producing organisations to institutional and environmental pressures (Ocasio and Radoynovska 2016; Kraatz and Block 2008; Canhilal et al. 2016) by empirically illustrating the aforementioned complexity at the level of the research groups. Research groups have been called “the most important piece of the scientific system in every society” (López-Yáñez and Altopiedi 2015: 629), and they are increasingly replacing individuals as the key loci of knowledge production (Wuchty et al. 2007); especially in an infrastructure-dependent field like nanoscience. Research groups are embedded in multiple fields based on their operational context, institutional logics and their own conceptualisation of the aforementioned factors (c.f. Paradeise and Thoenig 2013), establishing communities of practice worth investigating (Degn et al. 2017).

Drawing from Musselin (2000), we assume that the national contexts play a smaller role at sub-organisational than organisational level; although at the same time, the national resource competition is crucial also for those units that are otherwise oriented towards global competitive horizons (Kosmützky and Ewen 2016).

Hühter and Krücken’s (2016) nested organisational fields argument of other contexts in addition to the national context contributing to how organisations act, and notion that the

organisations' institutional logics contributes to what they do and how they position themselves, is geared towards the level of universities as organisations. Applying their framework at a sub-organisational level or research groups, embedded in a broader spectrum of organisations, we argue that research groups' segmentation and profiles are influenced by their perceived collaborative, competitive and organisational environment (Bleikie et al. 2017; c.f. also Aldrich and Ruef 2006). While research fields are dynamic and push for further divergence (Clark 1983), the internal dynamics of each field, given rise to by their understanding of knowledge as well as by their internal cultures and organisation (Becher and Trowler 2001), are also different. Therefore, the "academic tribes and territories", to paraphrase Becher and Trowler (2001) are different in multidisciplinary nanosciences than in some other research field or discipline. This is evident in the diversity of the organisational settings, but also in the internal constitution of the research groups, which varied in size as well as research specialisation. Nanosciences, which Heinze and Kuhlmann (2008: 889) define as covering "several disciplines and research areas, such as applied physics, materials science, physical chemistry, physics of condensed matter, biochemistry and engineering and polymer science and potential application areas as diverse as drug delivery, environmental sensing, manufacturing and quantum computing" emerged from multidisciplinary foundations in the 1980s (Cunningham 2017). It has established its position as a field on which there is fierce competition (Hullmann 2006) as well as active boundary work (Jo et al. 2016) and significant policy expectations (Kuhlmann 2001; Beumer 2018). Due to the wide range of potential applications, nanosciences research is conducted and applied in a great variety of settings and has wide-ranging societal impacts (c.f. Laherto 2010).

The research groups in this paper are, nevertheless, all treated as examples of an umbrella field of nanosciences, rather than distinguishing which particular element of nano-scale their research focuses on. Instead of treating profiles as planned outcomes of the research groups' conscious strategic activity (c.f. Fumasoli and Huisman 2013), i.e. presuming that the research groups would have explicitly aimed at being a "basic scientific research group" "broad strategic research group" or "applied service group"; we approach them as heuristics (c.f. Paradeise and Thoenig 2013) that emerge from the self-understandings and perceptions of research groups themselves in the context of their different external environments.

## Comparative small-N research design, data and analysis

Our small-n thematic, comparative research design (Bleikie 2014) was based on exploring the richness of missions, purposes, and self-perceptions arising from the multiplicity of institutional logics (Thornton and Ocasio 1999), nested organisational fields (Hüther and Krücken 2016), and institutional positioning inside a given national system (Fumasoli and Huisman 2013); and in relation to other geographical levels (Marginson and Rhoades 2002; Välimaa and Hoffman 2007). We followed a diverse case strategy (Seawright and Gerring 2008) and selected research groups operating in a single, relatively broad and policy-wise (Kuhlmann 2001) significant field of study, where research was conducted in multiple organisational contexts; and included groups based in three different countries.

We purposefully selected the cases based on our research interest by determining the primary contexts country and type of organisation (Bray and Thomas 1995). In designing the study, we presumed we would find more differences between groups located in

different organisational contexts, than those located in different countries but in similar organisational context. However, our analysis shows that neither of the external contexts are the sole defining factors in determining the research group profile. Instead, self-constructed perceptions of operational realities contribute to the positioning of different research groups (c.f. Fumasoli and Huisman 2013), supporting thus the argument made in previous research about no given sphere of action necessarily determining the outcome (c.f. Hüther and Krücken 2016). In this way, the study also contributes to the discussion on the role of individual and group construals, such as disciplinary or organisational perceptions about the nature of operational environment on change dynamics in knowledge production (see e.g. Becher and Kogan 1980; Clark 1983).

We discuss to what extent the three heuristic profiles converge with research groups being located in particular kinds of organisational types, usually and generally identified as knowledge producers. Finally, we discuss whether the research group profiles are related to particular kinds of geo-social orientations (c.f. Välimaa and Hoffman 2007; Hoffman et al. 2016; Kosmützky and Ewen 2016).

The data comprises eleven research groups which were selected on a combination of principles. We wanted to identify groups in diverse organisational settings, and encountered a limited number of options to choose from, due to the relatively small size of the three countries in question. Towards this, we decided to include the leading national research institutes. Also access played a role in selection; and we chose groups that we gained access to; which was not necessarily automatic given the competitive nature of the field. The data was collected through semi-structured group interviews with the group leader and 1–5 other group members in the different professional positions and stages of their career; managerial position, senior research position, and junior research position. In three cases – NE2, SE2, and SE3 – only a single person, typically the leader of the research group, was interviewed. The choice of interviewees was based on the contacted groups themselves, and for access reasons in cases SE 3, SE4 and CE2 the interviewees were in positions of managing a larger unit, comprising multiple different research groups engaged with different elements of research on the nano-scale instead of a single research group. The varying composition of the research groups reflects the different organisational principles of the organisations that host the research groups. This means the groups range from being the only groups in this field in their organisation to being larger units comprised of several smaller groups all working on different aspects of nanosciences. In this study, however, we pay attention to the organisational type (c.f. Poti and Reale 2000) rather than to the other organisational resources such as size, age or funding, some of which were considered proprietary information and not disclosed to us.

Interviews were recorded and extensive memos were used to document the interviews. Interviewees had a chance to check the memos and erase or amend them as they saw fit. As the research groups operate in relatively small countries and specialised fields, to preserve the anonymity of the groups, we withhold the exact information on the countries in which they operate. The data was analysed using qualitative content analysis with a bricolage of both data-driven and concept-driven coding of the data (Kvale 2008; Gibbs 2007), conducted in two stages and several rounds of deepening tiers of analytical understanding. In the first stage of analysis, we aimed to gain an understanding of all the richness and complexity of the qualitative data, while in the second stage, we aimed to enable comparability by reducing the complexity of the data.

During the three successive rounds of the first analysis stage, the data was organised by research group and interview question, and the most prominent features

arising from the interviews were noted down. Following that, short summaries were written for each of the research groups, highlighting the noted features according to broad categories related to the identity of the group, descriptions of collaboration and competition as well as the operational context. All elements that could be said to pertain to the topic of the study were identified and organised—from larger to smaller elements—into categories, dimensions and themes. This was followed by categorising the research groups according to the created elements, resulting in each research group exhibiting unique combinations of altogether 73 themes (Table 1).

It was obvious that after the first stage, further reduction of the complexity (c.f. Ebbinghaus 2005) needed to be achieved in order to establish comparison of the groups. This then became the aim of the second analysis stage. We looked at what kinds of combinations of themes emerged for each research group, and which research groups exhibited similar types of combinations. The themes in each dimension were grouped into larger group-theme composites based on what kinds of combinations of the basic themes were exhibited by the research groups.

The dimensions and group-theme composites were used to construct three collaboration profiles. To further reduce complexity and to enable us to construct some larger groupings, we included only eight dimensions, listed in Table 2, out of 13 as elements in the construction of the profiles.

In the final round of analysis, the groups were categorised under the three constructed profiles, with having to comply with at least five out of eight characteristics for the research group to be categorised into a given profile. The entire analysis comprising themes that arose from the analysis, the intermediary step of group-theme composites as well as the final selection of dimensions and themes for the construction of profiles and geo-social orientations are illustrated in a separate attachment available at <http://urn.fi/URN:NBN:fi:jyu-201904252282>.

The profiles are naturally ideal types (c.f. Paradeise and Thoenig 2013), heuristics that by necessity condense and hide the very complex operational reality of the research group, and the qualitative data presents limitations to generalisation of the feasibility of the profiles to a larger set of research groups, which remains a subject of further research.

## Research group profiles as a heuristic device

The heuristic research group profiles are aimed at abstracting and making sense of their mission, beneficiaries, collaborations and competitors, as well as way of funding collaborative activities. The three identified research group profiles are (1) Basic scientific research profile (BASIC), (2) Broad strategic research profile (BROAD) and (3) Applied service profile (APPLIED). Most research groups only matched one profile but two groups, NE2 and SE2, had equally “strong” BASIC and BROAD profiles. The research group profiles are described below, and summarised in Table 3, further down.

### Basic scientific research profile (BASIC)

The research groups holding a BASIC scientific research profile (NE2, CE4 and SE2) are distinguished by having a broad mission; meaning that they engage, in addition to

**Table 1** Basic information about the research groups

Research group	Geographic location	Organisation	Established	Composition	Constructed profile
NE1	Northern Europe	University	Centred around a professor who has held the post since 2006	Associated with an interdisciplinary research centre; 1 professor, 2 PhD students, one full-time and one part-time postdoc, and a varying number of master students and trainees are attached to the group.	BROAD
NE2	Northern Europe	National Research Institute	2009	Ten people, mostly research staff but also support staff and trainees.	BASIC, BROAD
NE3	Northern Europe	Regional technology development centre operating as a business entity	2007	Five people, but if needed other people from the centre can join the group for a project.	APPLIED
CE1	Central Europe	Regional research institute	Early 1990s	Research unit comprising ca. 70 people in five research groups, interviewees mainly from one RG	APPLIED
CE2	Central Europe	National research institute	2005, was at the time of interviewees in the process of being closed down due to organisational restructuring	The research unit comprised ca. 45 people in several smaller RGs. Some of these RGs had already left the organisation, others continued under other parts of the organisation.	APPLIED
CE3	Central Europe	Research-oriented SME	2005	14 people	APPLIED
CE4	Central Europe	University	n.a.	Centred around a professor and running a specialised research facility. 15 people, including 1 professor, 2–3 post-docs or senior researchers, 10 PhD students, varying number of diploma students.	BASIC
SE1	Southern Europe	University	n.a. (1980s)	Research group comprises four smaller sub-groups.	BROAD
SE2		University	Early 2000s		

**Table 1** (continued)

Research group	Geographic location	Organisation	Established	Composition	Constructed profile
	Southern Europe			Associated with an interorganisational research centre. Ca. 25 staff members.	BASIC, BROAD
SE3	Southern Europe	Research Institute	2011	Employs ca. 100 people under four RGs, still expanding at the time of the interview	APPLIED
SE4	Southern Europe	Technology development centre operating as a business entity	2006	Comprises three research groups, with altogether 40 people on permanent contracts and 10–15 on fix-term contracts.	APPLIED

scholarly basic research and researcher education, also to applied research, promoting local or national businesses, and/or product development and technology transfer. Thus, their mission does not necessarily distinguish them from the BROAD profile groups. The beneficiaries of the work of these research groups are also broad, i.e. they comprise both the scientific community and applied partners such as companies and technological centres, for example as well, other educational institutions. The funding of collaborative activities is largely based on basic institutional funding and multilateral competitive funding through national and international research funding frameworks, instead of, say, client funding. In their partner selection, the BASIC groups do not highlight acquiring specifically strategic partners.

The collaborations aim to produce scholarly outputs and/or research projects and, where possible, to capture new PhD students. They see especially universities and research institutes as their main competitors, and compete especially for producing the best science, i.e. the best research bringing recognition, prestige and awards, which ultimately translates to more funding and research capacity rather than competing for clients, as is the case with the other types of groups.

“Interviewer: What does competition mean in your opinion?”

Interviewee 2: Competition means that you are trying to do something first or better, or demonstrate something that has been theoretically predicted. That is why we say friendly competition, which means that if they get there first, we say “good job”, and if we get they’re second, they also say “good job”. This is not a winner takes all kind of thing.

Interviewee 2: Even when competing, they will help you and give you some helpful information, e.g. say that what you proposed won’t work, we tried that already. You pick each other’s brains. (CE4)”

However, as with any of the profiles, there are also differences between the research groups situated in this category. For example, whether the group hosts PhD students varies significantly between groups in degree granting and non-degree granting institutions; and even between different groups in degree-granting institutions.

**Table 2** Dimensions and themes included in the constructions of the profiles

Dimension	Themes included
Mission	Research group's perception of their mission, including (1) basic research, (2) researcher education, (3) applied research, (4) prototype/product development, (5) targeted problem--solving, (6) science-business bridge, (7) start-up development, (8) promoting national/local industry, and (9) technology transfer.
Primary beneficiaries	Research group's perception on who primarily benefits from their research, including (1) companies, (2) society/country/-region, (3) scientific community, and (4) own organisation.
Forms of funding collaborative activities with other groups or organisations	Funding of collaborative activities is based on (1) purposeful, bilateral project, commissioned and funded by/ tailored for company or companies (2) purposeful, multilateral externally, publicly funded project and (3) organic, non-funded basic research collaboration.
Important collaboration partner characteristics: strategically prioritised partner	An important characteristic of a collaboration partner is that it is among a small number of strategically prioritised partner organisations.
Modes of finding collaboration partners: marketing/strategic partnership building	When looking for collaboration partners, the research group actively markets itself and aims to build strategic collaborations with certain organisations.
Outcomes of collaboration	Outcomes resulting from collaboration include (1) scientific publications and presentations, (2) patents, (3) project proposals/funding applications, (4) targeted solutions/product development, (5) technology transfer, (6) start-ups and (7) dissemination of knowledge to public.
Competition for	Research group perceives that it primarily competes for (1) making advances in science/knowledge, (2) resources/funding (public, tendered) and (3) clients/client-funded projects.
Competitor definition: type of organisation	Research group primarily perceives the types of organisations it competes with are (1) companies, (2) universities/universities of applied sciences, (3) research institutes and (4) competence centres (nationally defined funding instrument).

### **Broad strategic research profile (BROAD)**

Similar to the BASIC groups described above, also the groups with a BROAD profile (NE1, NE2, SE1 and SE2) have a broad definition of missions and beneficiaries. The funding for their collaborative activities is based on basic institutional funding, multilateral competitive grants as well as funding from national or international clients to complete commissioned research tasks. Strategic partnerships are important, and the research groups aim to cultivate these, especially for further collaborations and network enhancement. The outcomes of collaborations are broad, comprising both scholarly outputs and applied outputs such as patents, product development, spinoffs or targeted process solutions. Like BASIC profile groups, they compete for being the best in science and for acquiring competitive research, but also for clients that would pay for their research. They see all kinds of knowledge-producing organisations, companies, as well as universities or research institutes as their competitors. However, there is a thin line between these competitors and collaborators considering that a competitor might become a collaborator and vice-versa, depending on whether the project they are working on at

**Table 3** Summary of the research group profiles and their geo-social orientation

Research group profiles	Research groups	Organisation types	Geo-social orientation		
			Global	Regional	Mixed
BASIC	NE2; CE4; SE2	Universities + research institutes	CE4; NE1;		
BROAD	NE1; NE2; SE1 and SE2	Universities + research institutes	NE2; SE2		SE1
APPLIED	NE3; CE1; CE2; CE3; SE3 and SE4	Research institutes, technology development centres and companies	SE3	SE4	NE3; CE1; CE2;

present has a pre-competitive or competitive aim. The BROAD groups may be more likely to have a multidisciplinary, case-specific composition compared with BASIC groups; and the composition of research group varies on project-by-project basis, depending in the expertise needed for each project.

“[Research group] is primarily an organisational unit or group inside a larger organisation, although it can also be a group assembled around a project. The word done by the research group is primarily project-based, so we try to find the most knowledgeable people for the project, which is easy in this organisation. The research group rarely comprises people from other organisations, although the composition of the research group may vary. Inside the organisational unit, there are typically several projects going on at the same time, and each of them has a few of the units’ members working on them; and this varies according to the size of the project and the needed expertise.” (NE2)

### Applied service profile (APPLIED)

The groups with an APPLIED profile (NE3, CE1, CE2, CE3, SE3 and SE4) are characterised by a mission focusing on various types of applied research and technology transfer, instead of scholarly basic research and researcher education that is present in the mission of the BASIC and BROAD groups. They view the beneficiaries of their work being companies and the society at large rather than the scientific community.

“We work mainly for the industry and with the industry. A large part of our research projects are very applied research for industry and industrial processes. This has been maintained over time. We also have some fundamental research projects, and these are directly linked with universities, in which we intend to develop our basic or fundamental research or transfer knowledge and apply it in industrial projects. This is the typology of our projects and hasn’t changed much. The main focus is on applying research targeted to the industry.” (SE4)

The funding of their collaborative activities is based on multilateral competitive funding or funding from paying clients, and strategic partnerships are perceived as important and aspired by the groups. The outcomes of collaboration are applied research, targeted solutions or knowledge disseminated to the wider public. Eventually, scientific publications may come

out of such collaborations, but these are not the main objective of these groups, and happen mostly when some of the members of the research group collaborate with individual academics or research groups based in universities. These research groups compete for clients and funding, rather than cutting edge science. They perceive companies, technology development centres and research institutes rather than universities as their competitors. Ultimately, they may also compete for status and prestige and pursue positions at the top of their organisational field. The composition and size of the teams may vary according to the project or purpose they aim to attain.

## Comparing research groups across profiles

As discussed above, we set to this comparative task with the preconception that groups operating in different organisational contexts would probably hold different profiles. Similarly, we presumed that research groups in similar organisational contexts would carry the same profiles, so that the different country contexts would not necessarily be reflected in the profiles.

While the limited scope of the data does not allow us to make statistical generalisations, the organisational context does not, contrary to our expectations, entirely seem to unite or divide the research groups holding a given profile. Only one of the university groups supports the BASIC profile, two have BROAD profile and one group can be said to have both. One group in a research institute has an equally strong orientation towards BASIC profile and BROAD profile. The APPLIED profile was most widely spread across different types of knowledge-producing organisations, three of the research institutes, both technology development centres and the only company in our sample that held this profile. While two research groups, NE2 and SE2 had a double BASIC-BROAD profile; the APPLIED did not co-occur in any group with either of the other profiles, making it the most distinct one.

In our aim to understand the processes of differentiation and profiling of research groups beyond the framework provided by the country or organisational context and to find some clusters among the very diverse research groups, we decided to analyse one of the elements that were left out of the construction of the original profiles in a bid to reduce the data complexity. Treating the profile, instead of the external contexts akin to an independent variable, reveals some differences between the groups in terms of how they perceive the geo-social orientation (c.f. competitive horizon in Vålmaa and Hoffman 2007; Hoffman et al. 2016) of their own work and their competitors.

## Geo-social orientation of the research groups

The geo-social orientation of the research groups, their work, collaborations and competitions, was probed in the interviews through, for example, question on whether the groups saw themselves or their competitors as regional, national or global players.

We constructed the geo-social orientation as a composite based on two primary dimensions: research groups' orientation towards the regional, national or global level; and their competitors' perceived geographical location, similarly at the regional, national or global level. We arrived at three geo-social orientations: global, regional and mixed, the last of which means that the work of the research groups or their competition was oriented towards all three levels (global, national and regional). There were no groups which would have primarily a national orientation.

BASIC groups (CE4) and groups that had both a BASIC and BROAD profile (NE2, SE2) held a global geo-social orientation; while those groups that only had a BROAD profile (NE1, SE1) had either a global (NE1) or a mixed (SE1) geo-social orientation (See Table 3).

The analysis shows that the APPLIED groups are more closely tied to the regional level both in terms of their own orientation as well as their understanding of where their primary competition lies, than the BASIC groups or BROAD groups.

“Interviewer: Do you see your research group primarily as a global or regional or national player – or is there a better way to frame what you do?”

Interviewee 5: Our scope is different, dependent on the topics. On certain topics we are European or even world leaders, in others we are just learning from the best. However, our focus is first and foremost regional, and our customers mainly [country]. We convey knowledge to companies that they do not have by themselves, although the knowledge may exist somewhere, like at MIT or other leading institutions.” (CE1)

This does not mean, however, that they would be solely tied to the regional level, only that the regional level is more relevant to them than it is for the other research groups. In fact, the mixed geo-social orientation was linked to most APPLIED groups. For example, the international influences or knowledge are important also for regionally oriented groups; they may see themselves as conveying the latest knowledge from the international arena to their clients operating regionally.

BASIC groups and BROAD groups were oriented towards a global level, with the exception of one BROAD group, SE1, which was linked to the mixed geo-social orientation. Having a global orientation was justified either in terms of competitiveness, or in terms of the nature of the knowledge: science being international by nature.

“Sciences in general are a field in which you cannot think of focusing to the national level, because research and its fora for publishing are always international. It is not possible to do [national] science for [country] markets”. (NE1)

## Discussion and conclusion

Our article is a contribution to the discussions on how organisations and their sub-groups operate in different contexts. Having started from a working hypothesis that organisational context would largely determine the profile of a given research group, we nevertheless found that neither the country context nor the organisational context completely justify the research group profiles. Instead, the data reveals that the self-perception of the research groups, mostly visible in the way they perceived and construed their work and their mission, i.e. their self-construction and self-positioning in their field of action, is a strong determinant of the research group profiles.

Unlike the institutionalist argument that the institutional logics (Thornton and Ocasio 1999) and field embeddedness (Hüther and Krücken 2016) determining those logics, and what organisations do, we argue that also the self-constructed contexts matter for what they do. They illuminate the different frameworks of logics that shift the profile of the research group from BASIC to APPLIED, and their primary geo-social orientation from global to local, according to each research groups’ perceived mission and collaborative and competitive context. Thus, while much of the institutionalist theory posits organisations as somewhat passive and primarily adaptive to their environments to secure legitimation or funding and competitive position according to their institutional logic or field embeddedness, we argue for seeing them as self-determined according to their profile and therefore, their embedded agency (c.f. Fumasoli and Huisman 2013).

Initially, we did presume that the organisational type would matter for the profile, and that the profile divisions would go neatly along the different types of organisations, which gave rise to our

sampling strategy. While one might presume that research groups based in universities fall under the BASIC profile, research institute groups under the BROAD profile and companies and technology-development centres operating as business units under the APPLIED profile, our analysis shows that the reality is more complex. The research groups exhibit elements of hybrid organisations, which draw from different logics and contexts in order to adapt to their complex operational environments (Bleikie et al. 2017). This reflects the changing dynamics and pressures of organisations whose objective is, ultimately, to produce knowledge, irrespective of whether their driving force is profit or producing scientific knowledge for society. While there did not, along with our expectation, seem to be a link between the profile and the country, this does not mean that the country context would not be significant for the lived experience of the research groups themselves. Previous research (Degn et al. 2017; Travaille and Hendriks 2010; Metcalfe 2008) shows that the country context is significant for funding, steering and legislation, and our interviews show that the research groups perceive these to be significant also for their own work. However, other elements of the self-constructed context determine the given profile.

The profiles do seem to bear some significance to the embeddedness of the research groups for the different geo-social levels of action, which are reminiscent of Hühner and Krücken's (2016) organisational fields, or Välimaa and Hoffman's (2007) competitive horizons; both of which acknowledge that multiple fields/horizons may bear importance for a given organisation at a given time. In our analysis, the research groups' and their primary competitors' orientation to the regional level was more prominent in groups holding an APPLIED profile, than for groups holding a BASIC or BROAD profile. Global orientation was significant for all profiles, but still more prominent for the BASIC and BROAD groups.

In terms of the limitations of this study, we found it challenging to allocate numerical minimum requirements for categorising a given group to a given profile, and thus also to force the complex reality to hermeneutic boundaries represented by the profiles. For example, as the profiles were constructed around complying with just five of the eight possible characteristics of a given profile, it means that while the profile of two groups may be the same, one may be complying with more of the characteristics than another one. For example, SE1 and SE2 both hold the BASIC profile. However, SE2 complies with seven out of eight characteristics that make up the profile, while SE1 only complies with five out of eight. Similarly, while SE2 complies with seven out of eight characteristics of the BASIC profile, it only complies with six out of eight characteristics of the BROAD profile. Therefore, one might conclude that for SE2, the BASIC profile is "stronger" than the BROAD profile. In contrast, NE2 complies with six out of eight characteristics on both BASIC and BROAD profile, making both profiles equally "strong". However, careful reading of the entire interview would indicate the research group to rather be more BROAD than BASIC in terms of its profile; even though, this overall orientation is partially disguised in the process of distilling the profiles and numerically counting the characteristics that make up any given profile.

These limitations of the qualitative study also give rise to further research with a quantitative research design, that would allow for testing of the profiles with a larger set of research groups; as well as hypothesising further the relationships country and organisational context and their impact, not just separately as was our initial but also expectation, but also concurrently. Such a design would also enable controlling for a variety of research group characteristics such as size, age or particular research specialisation inside the broader field of nanosciences, or broadening the scope of investigation from nanosciences to other research fields, to better take into account the impact of the organisational resources and the disciplinary

context on profiles (c.f. Becher and Trowler 2002). Finally, a larger body of data would allow for modelling of different types of competition and collaboration between the organisations in the shared broad field (c.f. Aldrich and Ruef 2006), and the relationship of these with the positioning of the said organisations (c.f. Fumasoli and Huisman 2013; Seeber et al. 2017).

In sum, the different research group profiles can be seen as heuristic devices that could be applied and tested in different contexts and with larger data sets, offering a tool for cross-case comparison that is easy to read and apply. We believe that this study also sheds further light on the dynamics of organisations' adaptation and agency in their operational contexts.

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