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Incentivation of the ?right? academics for participation in industry clusters

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Abstract

This paper examines the motivating potentials inherent in different configuration parameters of regional cluster initiatives. We argue that specific settings of regional industrial cluster policies suit for the involvement of the ?right? academic researcher. Whilst some parameters might just motivate for a short term engagement or low contributions, we search for those to stimulate highly ambiguous experts on a long term perspective. By combining previous work on cluster policies and university-industry relationships with acknowledged theories from decision sciences, we develop differentiated hypotheses about the motivational forces of particular cluster design factors. We utilize

Conjoint-Measurement based on scenario descriptions of fictitious cluster structures to measure the particular motivating potentials inherent in the cluster parameters. To allow for contingency analysis, we include the number and quality of individual research publications and long-term cooperation orientation as covariates. Our study is based on a survey among 104 professors in Germany from the disciplines of engineering and physics. We calculate relative propensity score for participation in different policies for diverse groups of academics. We show, that research funding is a main incentive for an academic researcher to participate in a regional industry cluster. Furthermore, congruence with the own research focus and reputation stimulate the participation propensity. Spatial distance is negatively perceived. Overall, the study shows, that academic researchers are highly driven by extrinsic motives and less by their research interests when it comes to cooperation with industry clusters.

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Abstract

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Introduction

To increase competitiveness and to ensure sustainable success, it becomes increasingly indispensable for technology-oriented businesses to join inter-company networks and to enter into development partnerships with academia (Azagra-Caro, Archontakis, Gutierrez-Gracia, & Fernandez-de-Lucio, 2006). By doing this, individual core competencies can be bundled and the success potential of every participating player enhanced. In this way, common strength of multiple network partners can become much higher than the mere sum of their individual abilities. The importance of collaborative partnerships is recognized by both industrial sectors and government agencies. The government increasingly fosters policies to facilitate research partnerships between universities and commercial organizations (Butcher & Jeffrey, 2007).

Partnerships between industry and academia are particularly often initiated in the form of industrial clusters with the purpose to increase the wealth and competitiveness of a region (Vedovello, 1997). According to Porter (1998, p.78), "*Clusters are geographic concentrations of interconnected companies and institutions in a particular field*". Regional competitive advantages evolve due to knowledge-intense relationships and collaboration under geographic proximity that distant rivals cannot meet (Porter, 1990). Most cluster initiatives focus on regional development. This implies creation and diffusion of innovations between indigenous companies and research institutions.

Previous research shows a positive effect of agglomeration on the innovative output of a region. This effect has primarily been ascribed to the potential that knowledge can spill over among clustered actors and disseminate in a region. Clusters can reduce potential friction losses due to geographic proximity and direct communication channels and also further a common understanding amongst local actors in the course of frequent interactions (Hage & Hollingsworth, 2000). Furthermore, the innovative potential may increase because of the diversity of industries and activities in a region enabling multiple entries to problem-solving (Fritsch & Slavtchev, 2009). This effect increases with an access to diversely qualified human resources (Iammarino & McCann, 2006).

A major driver of regional innovation development can be seen in contributions by academic researchers (Fritsch & Slavtchev, 2007). Mansfield (1991) postulates that about one-tenth of commercialized new products derive from academic research. Different studies show that a significant relation between academic R&D and innovative output of regions exists (Fritsch & Slavtchev, 2007; Jaffe, 1989; Mansfield, 1991; Mansfield & Lee, 1996; Rothaermel & Ku, 2008; Sharma, Kumar, & Landale, 2006). Especially more radical innovations to a greater extent rely on advanced scientific knowledge generated by universities (Klevorick, Levin, Nelson, & Winter, 1995; Tödtling, Lehner, & Kaufmann, 2009). Research universities generate consolidated basic findings through basic research which spill over to firms to exploit (Jaffe, 1989; Mansfield, 1991; Marshall, 1920). Firms take the role of translators of academic knowledge into commercial returns (Murray, 2004). This effect relies to a high extent on the quality of academic research in a particular cluster. Frisch and Slavtchev (2007) show that neither the pure existence of universities nor the number of researchers in a region significantly contribute to the regional innovative output, whilst the intensity and quality of the research does. Therefore, it is of high relevance for policy makers to integrate "right" academics, i.e. those scientific researchers who conduct high-quality research. It has been argued that the mere involvement of a professor does not necessarily support high-quality research. As mentioned above, innovativeness also requires an intense interaction for knowledge transfer and a certain level of engagement from the researcher. Additionally, not every academic is able to deliver a high-quality research. Zucker et al. (1998; 2002) argued that industry alliances with "star" academics lead to a substantially higher firm performance than relationships with any other university academics. Furthermore, not just the status within the scientific society determines the performance-enhancing effect of an affiliation with university researchers. An optimal match between "right" academics and industry partners leads to productive collaborations where academics team-up with firms they have the strongest compatibility with and can consequently render higher results (Mindruta, 2009).

To guarantee efficiency and intensity of joint activities within regional clusters, each of the involved partners needs to be motivated adequately. What is problematic about this is that universities and companies are motivated differently (Mora-Valentin, Montoro-Sanchez, & Guerras-Martin, 2004; Vedovello, 1997). Whereas the benefits from cooperation for industrial actors are quite evident (i.e. expertise utilization), the benefits for involved academics, especially "star scientists", are not that transparent and returns from collaboration are less quantifiable and also more mixed. Typical objectives of academics concern pursuing a successful scientific career which can be achieved by international exposure and publication outputs (Azagra-Caro, 2007). It remains questionable whether the reputation of academics can be enhanced through their participation in a cluster organization (Blumenthal, Gluck, Louis, Stoto, & Wise, 1986) or can be rather damaged by this. The same ambiguity applies for the potential to publish outcomes as well-recognized scientific papers. Further obstacles arise from the perceived threat that universities may become a sort of R&D sections of companies (Camilleri & Humphries, 2005; Lee, 1998). Bok (1991) argues that a research to exploit competitiveness for the industry would end by disappointing the academic constituencies to their ultimate disadvantage. These threats for academics show that the willingness for an engagement is questionable. Therefore, such collaboration needs to be stimulated by systematic implementation of incentives. To define appropriate incentives, it is necessary to ascertain what motives professors can have to engage in cooperation projects with industry.

Whereas the motivation of company actors to engage in industry-university collaborations is well researched (Teichert & Rost, 2004), we observe a lack of studies which examine the motivation of academics (Boardman & Ponomariov, 2009; D'Este & Patel, 2007). This constitutes a relevant research gap, as academics at universities can freely opt to engage in cooperation within industry clusters or not. Our research might also explain why policymakers often experience that specific design parameters of cluster policies do not stimulate those people intended to involve (Iammarino & McCann, 2006; Kim & Yoo, 2007). To focus our research, we formulated the following **Research Question** which we intend to answer by our study:

What kinds of incentives should industrial cluster initiatives provide in order to motivate the "right" academics to participate in them?

For a comprehensive assessment of motives of professors and incentives for them, we apply the incentive-contribution theory (March & Simon, 1958) to the results of previous theoretical and empirical work. On the basis of the theory, we analyze and evaluate the motivating potential of different cluster settings on specific kinds of professors and develop a set of theoretical hypotheses. We intend to align cluster settings to the major motives of academics during cluster involvement. Then we transform the motivational factors into close to reality cluster scenarios and test our hypotheses empirically in an experimental setting based on conjoint-measurement. The objective is to determine measurable motivational potentials of each dimension of cluster settings as well as the interdependencies among them. The results will be subsequently presented. Additionally, the research will link the motivational potentials to individual types of academics to ensure that the "right" academics get engaged in excellence clusters.

Theoretical Background and Hypotheses

Former research on the underlying factors of cooperation showed that participants expect to meet their individual objectives while engaging in collaboration. Scholars argued that the well-known incentive-contribution-theory (March & Simon, 1958) explains the necessary level of stimulation. The theory postulates that the equivalence of incentives provided by an institution and of effort from the participant's side is an inevitable requirement for a long-term engagement. It means, a durable equilibrium between incentives and contributions is to prevail. In practice, "*partners remain with the cooperation as long as the benefits that they can derive from it outweigh the value of the input required*" (Brockhoff & Teichert, 1995, p. 119).

We understand incentives as situational factors which are able to activate the existing motives of an individual and to lead to a behavior in accordance with the objectives of a cluster. The incentives can be induced monetarily and non-monetarily regarding specific needs of an actor (March & Simon, 1958). Managers of cluster initiatives need to incorporate such incentives into their policies which are of permanent value to the scientific contributors. On the one hand, if scientists are motivated extrinsically it is possible to stimulate their participation through financial incentives. It has been shown by different researchers that funding opportunities increase the willingness of university researchers to attend collaborative university-industry programs and engage in consulting activities (Arvanitis, Kubli, & Woerter, 2008; Lee, 1996). On the other hand, those academic professors who are motivated mainly intrinsically can be also motivated by non-monetary incentives. Such non-monetary incentives encompass context-specific factors of ideal or personal nature which are appreciated by the participant. Barnard (1968) subsumes *ideal incentives* by structures and processes within an organizational setting which provide room for self-fulfillment, and *personal incentives* by prestige effects of membership in a specific company. In a cluster context, non-monetary incentives stem primarily from the design of a cluster policy. Those need to be incorporated in a pre-utilization phase and, thus, can be influenced just indirectly upfront.

While utilizing non-monetary incentives, cluster management can firstly address *ideal incentives* that are directly linked to the intrinsic task-related motivation of actors. The intrinsic motivation that drives a professor's contribution emerges from the working style and the degree of autonomy but is also considerably dependent on the congruence of the cluster research focus with the specialization of an academic. Only if a professor has an honest interest in a research topic, real intrinsic motivation can be expected. Cluster managers cannot influence the strength of ideal incentives directly but only indirectly by adaptation to personal research interests and flexibility in terms of different approaches to problem solving (Marvel, Griffin, Hebda, & Vojak, 2007).

Second, policy makers can influence *personal incentives*. The geographic location of the cluster relative to the home location of a professor influences the perceived personal incentive for participation. It has been argued that academics are driven by the feeling of regional responsibility and seek for the prosperity and development of their home region (Lee, 1996). As mentioned before, the aims of different partners in a cluster diverge. The effort/outcome relation of the university-industry relationship depends on the personal goals and definition of success (Butcher & Jeffrey, 2007). As stated by March and Simon (1958), a long-term equivalence of incentives and contributions is mandatory for the motivation of members as well as the value creation for the organization. It is of high relevance that individuals are not just motivated for an engagement but also capable of the tasks to perform. Therefore, for studying the motivational effects under an incentive-contribution perspective it is necessary to consider the individual contributions a professor can deliver to the initiative.

For this reason, we include personal covariates to our model. Academic researchers can be separated by three discriminating aspects. First, the quality of previous research outputs indicates those academics who can be highly beneficial in terms of scientific achievements. Second, for a long-term success of a cluster collaboration partners' involvement should be effected on a long-term basis. Consequently, long-term orientation should be a prerequisite for attendance. Third, the scientific field of the academic determines if cluster policies can rely on basic research and, thus, radically new knowledge or applied science and, thus, commercialization of rather incremental improvements. Whereas the first two aspects can segregate researchers of all research fields and, thus, be actively considered in the selection of academic partners, the third aspect is related to the research discipline and needs to be considered more passively regarding the cluster orientation. Following this view, a conceptual model as presented in Figure 1 can be deducted.

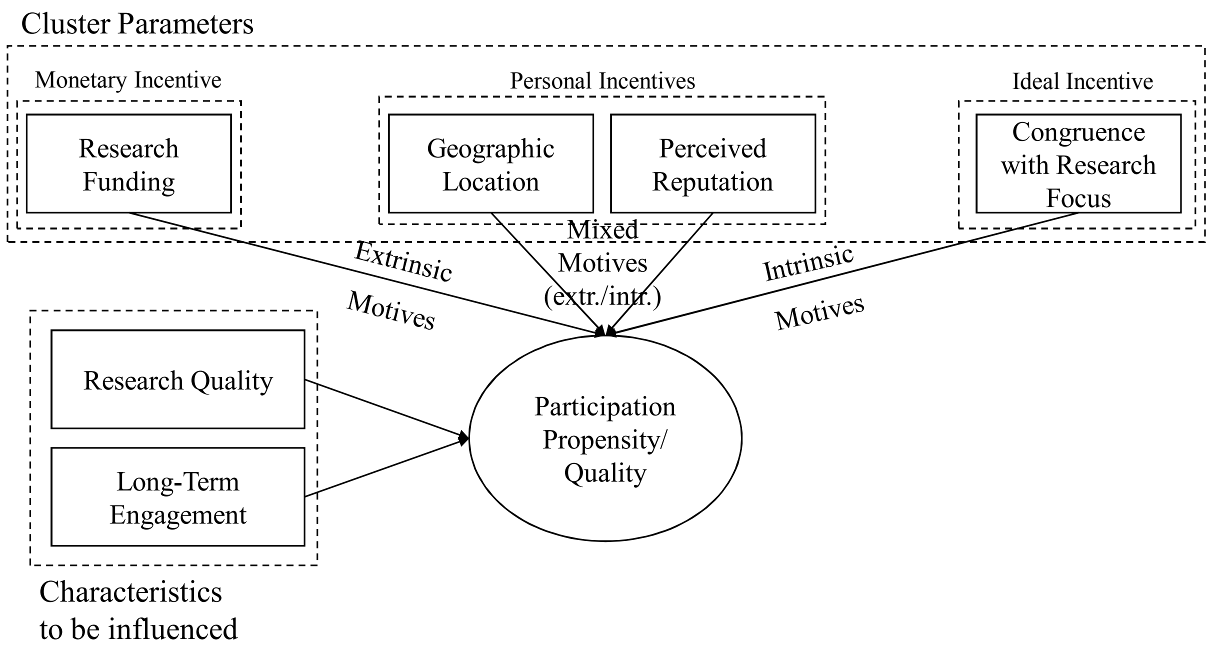


Figure 1: Conceptual incentive-contribution model of cluster participation

In the following section, we deduct specific hypotheses on the motivating potential of particular cluster parameters from the literature. For this, we review studies on design parameters of clusters and conditions of university-industry-relationships as well as acknowledged theories from decision sciences. The subsequent argumentation subsumes the underlying incentives within particular cluster settings and mirrors the effects for the specific preference structure according to personal characteristics.

Research Funding

Research funding is an essential source for research universities to enable the realization of costly high-quality research projects (Sandström, 2009). With respect to regional clusters, financial resources have been empirically linked to the research success of the clusters (Rothaermel & Ku, 2008).

Researchers often depend on financial support from industry-related funds to successfully realize their research. Academic institutions can even adjust their research projects according to the requirements of the environment in order to obtain supplementary financial resources (Van Vugth, 1999). A growing acceptance of commercialization of research activities in academic circles leads to a change in the traditional incentive system for academia. Along with traditional reputation-based system, also monetary incentives become increasingly important (Lam, 2010). Taking recent reduction of public funds for research activities into account, cooperation between universities and industry opens new horizons to academics. Both scientific institutions and academics can profit from collaboration with the industry. Research institutions can obtain necessary third-party funds for high-quality research, whereas academics can be additionally rewarded financially for the commercialization of their research results (Göktepe-Hulten & Mahagaonkar, 2010). The anticipation of funding opportunities can have a motivating effect on academics.

The impact of monetary incentives on the readiness of the researchers to cooperate with the industry has been often investigated empirically. However, the empirical results do not deliver a uniform picture. Several studies prove a positive impact of monetary incentives on the readiness of research institutions to engage in cooperation with the industry (Lach & Schankermann, 2008; Owen-Smith and Powell, 2001). On the contrary, other studies substantiate that monetary incentives do not play a significant role (Markman et al, 2004; Colyvas, 2002). However, the majority of the studies do not consider personal motivation of individual researchers. Recent studies which deal with the individual motivation processes of researchers rather detect that monetary incentives in form of personal remuneration do not determine the motivation of researchers. Main motivational determinants are rather ideal- and reputation-based factors. (Göktepe-Hulten & Mahagaonkar, 2010; D'Este & Perkmann, 2011;

Audretsch et al., 2010). In this respect, researchers favor the participation in commercial cooperation only then if there are accepted entrepreneurial norms in their academic environment (Bercovitz & Feldman, 2008).

In contrast, some other studies substantiate that monetary incentives in form of an additional individual remuneration can be of high relevance for the individual motivation of scientists. These suggest a new type of scientist, a "new entrepreneurial scientist" who is motivated by monetary incentives (Etzkowitz, 1998; Slaughter & Leslie, 1997). The impact of monetary incentives on scientists is studied by Lam (2010). The author especially investigates to what extent commercial cooperation activities of scientists (e.g. engagement in creating patents, licenses and spin-offs) can vary in dependence of the personal internalization of academic values and norms. Lam (2010) states that "entrepreneurial scientists" defined as "scientists who see the boundaries between academia and industry as entirely permeable and (…) (who) believe in the fundamental importance of science-business collaboration for knowledge application and commercial exploitation" (Lam, 2010, p. 15) evaluate monetary incentives in form of personal benefits as especially important motivators. Audretsch et. al. (2010) confirm in their study that personal financial benefits increase the willingness of academics to participate in university-industry cooperation. The results of the study show that both monetary and reputation-based factors have a significantly positive impact on the appeal of cooperation for academics. D'Este and Perkmann (2011) derive from their study on the impact of monetary and non-monetary incentives that financial remuneration is an important source of motivation for academics to participate in joint research, contract research or consulting activities. This leads to the following hypothesis:

Hypothesis 1: Academics prefer collaboration within clusters with high monetary incentives.

In the context of academics' research contributions to regional clusters, the effect of monetary incentives is determined by personal orientation. It can be argued that academics who perform high quality research and publish their research contributions on a regular basis are already renowned within the scientific community. These do not require clusters to perform their main research interests, because they were able to publish their research results before. Additionally, research outputs in terms of regular publications are related to the financial situations of faculties. In his investigation of 151 Swedish professors, Sandström (2009) finds a weak interrelation of the height of research grants and the quality of research publications. Funding opportunities usually go along with the creation of new positions for research fellows who administer scientific knowledge and productivity. Van Looy et al. (2004) show that industry funds stimulate publication activity as resources of institutions increase. Successful professors base their scientific status on acknowledged basic findings and previous scientific breakthroughs. Thus, for these researchers reallocation of time towards cluster research does not harm a scientific career. Successful researchers are also well aware of their capabilities and market value. They might internalize external incentivation to a higher extent than those who are still at the beginning of their scientific career. From that point of view, we assume:

Hypothesis 2: Academics` motivation for cluster participation is strongly (weakly) driven by monetary incentives if his/her research contributions are highly (lowly) visible in the international scientific community.

Monetary incentives can constitute an appropriate way of attracting foremost those academic researchers who see participation in a cluster as a practical fundraising opportunity. Monetary incentives enable researchers to pursue research activities and rely on extended budgets.

Regarding the proposed equilibrium of incentives and contributions it would be necessary that scientists value incentives provided by cluster management constantly highly during their engagement. It is rather questionable if monetary contributions can lead to constant effects over time. Motivation theory shows that permanent extrinsic motivation becomes internalized on a long term base and the effect of future rewards decreases (Edward L. Deci, 1975). Since the motivating potential of extrinsic rewards is of an instrumental nature, the motivating effect withers after the higher order objective. While the main driver of university academics can be seen in personal inquisitiveness, the benefits of industry grants to researchers are of a rather short-term, project-specific nature. Banal-Estanol and Macho-Stadler (2010) argue that the allocation of an academic's time is partially directed to commercializing (development) and to research activities. Development activities are geared to anticipated financial payoffs of projects. The amount of research activities can be substituted in part by high-value projects but counter-balancing effects will redirect interest to research activities in the long-run. It has been argued that scientific values reduce the likelihood of pursuing interactions with private companies but such values are foremost curiosity-driven and based on long-term engagement. (Boardman & Ponomariov, 2009). From this argument, we assume that in order to secure financial resources for future research activities, academics would be motivated by industry grants on a short-term basis. Therefore, we propose:

Hypothesis 3: Academics` motivation for cluster participation is strongly (weakly) driven by monetary incentives if they have a short-term (long-term) collaboration orientation.

Congruence of Cluster Research and Academics` Research Focus

Intrinsically motivated behavior is regularly stated if people engage in an activity primarily for its own sake (Deci, 1975). This kind of motivation stems from an individual's volition for self-development (Deci & Ryan, 1987). Intrinsic motivation applies to the non-monetary component of ideal incentivation since it is closely linked to the opportunity for self-fulfillment. Intrinsic motivation is inherent to individuals. Therefore, management cannot actively create intrinsic motivation but rather support its development (Marvel, et al., 2007). Intrinsic motivation increases in a working context that fosters autonomy and perception of competence (Ryan & Deci, 2000). From a researchers point of view, highest personal interest can be expected in the case of congruence between the research intent of the cluster policy and the own research focus of the scholar. This implies a low knowledge distance between scientific knowledge and relevant development competence for a cluster research topic (Schartinger, Rammer, Fischer, & Frohlich, 2002). In such situations, academic researchers can simultaneously satisfy their curiosity as well as the objectives of the cluster policy. Additionally, clusters can create intellectual networks among participating academics. Beaver (2001) finds evidence that research collaborations are intrinsically motivated simply by common intellectual interests among partners. Story et al. (2008) argue that work ethic and excellence would be facets of intrinsic motivation as well. It means that intrinsically motivated researchers would also care about others in the cooperation and seek for the first class performance of the community. Taking this into account, we assume:

Hypothesis 4: Academics` motivation for cluster participation depends on congruence with the research focus.

Psychological studies indicate that intrinsic motivation differs between individuals depending on the individual preferences (Deci & Ryan, 2000; Ryan & Deci, 2000). Thus, the motivating potential of the research activity within a cluster policy is likely to vary between different types of academics.

Intrinsic motivation is closely linked to a high degree of self-identification with a task or the context in which the task is carried out. Kuvaas (2006) demonstrates empirically that individuals who are intrinsically motivated show a higher affective commitment to the organization. This leads to a high valuation of the participation and low switching intention to other research projects (Vansteenkiste et al., 2007). If a researcher aims for long-term engagement, a permanent motivation is required. Intrinsic motivation through congruence of personal research interests and the research focus of the cluster is likely to be valued constantly highly by an academic. Hence, a durable equilibrium of incentives and contribution can be expected. Therefore, we propose:

Hypothesis 5: Academics` motivation for cluster participation depends highly (lowly) on the congruence of the cluster research focus and the one of the academics if they have a long-term (short-term) collaboration orientation.

Cluster Location

One important driving force for a participation of academics in university-industry relationships has been identified in geographic location of the partner companies or institutions. Spatial proximity is an important factor for knowledge transfer between academia and industry. It can be argued that universities are increasingly involved in the cooperation with the industry due to their geographical closeness (Bramwell & Wolfe, 2008).

Various studies investigated the relation between spatial proximity and the perceived success of joint activities. However, those studies did not retrieve consistent results. Schartinger et al. (2002) found a weakly significant inverse effect of distance on the frequency of contract research. Arundel and Geuna (2004) confirmed that result by comparing five information sources where proximity effects were greatest for public research organizations. On the other hand, neither the study of Beise and Stahl (1999) nor that of Mora-Valentin et al. (2004) were able to find a significant relationship between the distance between actors and the perceived success of the collaboration. Vedovello (1997) could not even find a strengthening effect of proximity on university-industry relationships.

This heterogeneity of results might be caused by the direction of choice. For instance, Gibson et al. (1994) argued that corporate R&D consortia are often located near universities. Similarly, Matuschewski (2006) stated that interviewees from East-German companies considered proximity to research institutions explicitly for strategic reasons because of access to qualified staff and specialized knowledge. Hence, proximity effects would rather stimulate companies to collaborate with public institutions and not conversely professors to participate in private-public partnerships.

This constraint also applies to the main argument for regional proximity found in the literature. A motivational force of spatial proximity for professors from academia could arise via considerations on social responsibility. From that point of view, proximity effects are related to the personal incentives within a cluster initiative, since individuals pursue activities that represent personal ideals. The social responsibility theory states that academics are engaged in the production of public goods and feel responsible for national and regional development in terms of technological advancements and knowledge distribution (Bok, 1991). Lee (1996) finds some support for the assumption of social responsibility perceived by university researchers. In his large scale study on US researchers from academia, 83% of the respondents agreed that the research university should undertake an economic development role. Atakan and Eker (2007) indicate via interviews with members of a Turkish university that social responsibility is widely shared by researchers. They also find that social responsibility explicitly regards contributions to the well-being of local communities. Social responsibility indicates that spatial proximity could determine a participation decision of an academic scientist because of the feeling of responsibility for the regional wealth intensified by social affiliation. This effect reflects the philosophy of a researchers' responsibility to share his knowledge with the public economy. Such general traits are not linked to specific projects but endure over time.

Spatial proximity is assumed to enable personal interaction among partners (Schartinger, et al., 2002) and, thus, to facilitate the development of strong ties and the transfer of knowledge. Whilst the transfer of codified knowledge is a straightforward process that can be utilized automatically via mail or telephone, personal interactions are crucial for the transfer of tacit knowledge (Asheim & Gertler, 2005). Transfer of tacit knowledge requires special transmission channels and becomes increasingly costly with geographical distance (von Hippel, 1994). Gellner (1994) postulates that the dissemination of knowledge requires a social framework where an open discourse about new ideas as well as a joint investigation of problems can take place. Spatial proximity tends to foster personal ties and, thus, facilitates creative joint activities (Iammarino & McCann, 2006) and transfer of tacit knowledge (Lagendijk & Lorentzen, 2007). Therefore, the following hypothesis can be formulated:

Hypothesis 6: Academics prefer collaboration within clusters in spatial proximity.

A problem with the engagement in clusters stems from the limited regional scope. Whilst the perceived success of a cluster is highly determined by the involvement of the best of the best, proximity as the driving force constrains participation of global players. The regional participation does not target widespread researches or implications with a global scope. The regional orientation of most cluster initiatives induces that the opportunities for an increasing reputation from the international scientific community due to cluster research are low. In combination of the assumed conflict of the individual objectives of professors and the regional limitations for clusters, it is questionable whether top-level academics would be willing to participate in such partnerships. An opportunity for an international oriented researcher from academia arises from an engagement in international clusters. Whereas businesses need to be indigenous incumbents in a region to become members in a cluster, this would not be a requirement for scientists. As regional clusters are not isolated systems (Grabher, 1993) but also integrated in multiple external interactions, knowledge exchanges with foreign researchers are not restricted.

Modern research relies on an international orientation and, thus, on a global flexibility of the ambiguous academic expert. Recognition in the scientific community is especially based on global exposure of research findings. Academic science is in many respects an international endeavor and firms in all countries draw on the findings of domestic as well as foreign academic research (Mansfield, 1991). In line with our argumentation on intrinsic motivation, we assume that for top-researchers the motivational potential of international cooperation prevails the potential of clusters in regional proximity. Azagro-Caro et. al. (2006) even state that science transfer within regional clusters is an incentive with negative sign for academics. This is especially relevant if academics are renowned in the scientific community and need to actively maintain an international expert status in a specific research field. Therefore, we assume:

Hypothesis 7: Academics prefers international cooperation as compared to cooperation within clusters in spatial proximity (or vice versa) if their research contributions are highly (lowly) visible in the international scientific community.

Reputation

A major motivational factor for the propensity of professors to participate in regional clusters stems from personal incentives. In this regard, reputation may constitute a primary motivational force immanent in specific clusters settings (D'Este & Patel, 2007; Mora-

Valentin, et al., 2004). Reputation of a cluster can lead to two motivational forces. First, spill-over effects of reputation can lead to an increased recognition of a researcher within the society (Lieberman & Montgomery, 1988). Second, social identity theory (Tajfel, 1974, 1982) indicates that being a part of a group that represents desirable characteristics leads to enhancement of self-esteem.

Gains in reputation not only depend on the physical outputs of a collaboration project but also on the preexisting reputation of the cooperation partners in a network. Teaming up with others (e.g. with other renowned researchers) would consequently induce spill-over effects on the entire community. Both the firm and the university professor need to hold good industrial and research credentials (De Laat, 1997; Geisler, Furino, & Kiresuk, 1991). While organizational reputation predominantly refers to past achievements and performances of the network as an entity, that is, its technological, productive or commercial excellence (De Laat, 1997; Gray, 1985), personal reputation is marked by the professional experience of the members working in a cluster (Bloedon & Stokes, 1994). Mora-Valentin et al. (2004) find a significant overall effect of the perceived reputation of involved academics on the perceived success of participation in cooperative agreements. Therefore, we propose:

Hypothesis 8: Academics prefer collaboration within clusters with high reputation.

Reputation has also been shown to correlate positively with intrinsic motivation (Roberts, et al., 2006) and intrinsic motives are linked to feelings of social identity (Ellemers, De Gilder, & Haslam, 2004). The potential enhancement of reputation is highly relevant for professors because academic careers mostly rely on reputation (Azagra-Caro, 2007). From this general orientation, the incentive of reputation becomes internalized and leads to self-determination and perceived autonomy. Also reputation effects can be assumed to be of special relevance in the own research areas of a participating academic. This holds because reputation within the closer scientific circle has a direct influence on the status within a field of experts.

Several recent publications (Dasgupta & David, 1994; Göktepe-Hulten & Mahagaonkar, 2010; Bruneel et al., 2010) state that successful academia-industry cooperation may be auspicious for a participating academic in terms of scientific reputation. The potential for the scientific reputation increase lies in better visibility and dissemination of the own research as well as in prospective results recognition in the community.

However, reputation from cluster participation is also able to damage a researcher's reputation in the scientific community as it neglects basic research and academic publication activities (Arvanitis, et al., 2008). Central indicators of scientific reputation of an academic are the number of publications in refereed journal articles, the number of monographs (quantity aspect) and the number of citations (quality aspect). Additionally, research awards and participation at conferences are favorable for scientific reputation.

Since not only positive reputation spills over, there is also a risk of image losses through not prestigious activities of the cooperation partners. In most cases the objective of cluster policies lies in the improvement of regional efficiency or the joint generation of new products. Scientific breakthroughs typically exceed the scope of regional engagement and cannot be taken into account upfront. In this sense, cluster engagement might not be adequate to gain scientific reputation and to strengthen an already existing prestige in the scientific community. Therefore, we suggest:

Hypothesis 9: Reputation effects strongly (weakly) influence academics` motivation for cluster participation if their research contributions are highly (lowly) visible in the international scientific community.

Empirical Investigation

Method

Although the number of worldwide cluster initiatives increased, a study of real network structures can hardly deliver a comprehensive dataset for generic conclusions. Individual clusters are influenced by a multitude of different factors such as industry, culture, number of partners, financial budget etc. Hence, an evaluation of real clusters would be influenced to a high degree by multiple contextual factors and would distort accountability of results to specific parameters.

Therefore, we suggest using Conjoint Measurement (Teichert, 2001) based on scenario descriptions of fictitious cluster structures. Conjoint Measurement is a well-established method in marketing to measure preferences and to forecast decisions. By applying this approach, interviewees are asked to rate potential cluster settings on the basis of a holistic assessment according to their individual preferences. Decision makers base their decision on a holistic assessment of the scenario consisting of close-to-reality attributes. Conjoint Measurement as a decompository approach fits the real-life decision-making process since reality decisions in most cases occur in a complex environment and under uncertainty (Teichert, 1993). Several studies showed that Conjoint Measurement leads to a valid assessment and reliable results (Reibstein et al., 1987, Green & Srinivasan, 1990). By statistical decomposition of rated choice sets (stimuli), part-worth-values (indicating the relative importance) of the particular attributes can be estimated. Additionally, trade-offs between parameter specifications can be quantified. The relative importance of attributes and their interaction effects can be analyzed on the individual and the aggregated level.

Operationalization and Survey Design

To test our hypotheses we defined four key features connected to the motivational dimensions inherent in the theoretical argumentation (Table 1). These key features are deducted by the review of previous work on the determinants of cooperation, several discussions with experts from different fields of academia, and a pilot survey conducted via telephone. All variables are relevant and discriminating. The levels of each attribute represent dichotomous opposite pairs indicating whether the incentive takes place or not.

From explorative interviews we obtained valuable information on the possible operationalization of the variables. Since research funding represents a sensitive topic among researchers and could bias the answering behavior, we related the financial incentive to research budget. *Symbolic incentives* cover marginal allowances for special expenditures. *Substantial funding* on the other end represents full funding for future research projects. Ideal incentives have already been conceptualized via congruence of cluster research and the research of a professor. Thus, we operationalized this construct via *core area of research* vs. *peripheral area of research*. The geographic cluster location is a rather manifest construct and could be operationalized in a straightforward way by distinguishing between clusters at the *university location*, and *international clusters* as seen from an academic's perspective. Reputation from cluster participation was perceived by interviewees in a reliable way and, thus, could be operationalized by two values, *low* and *high.*

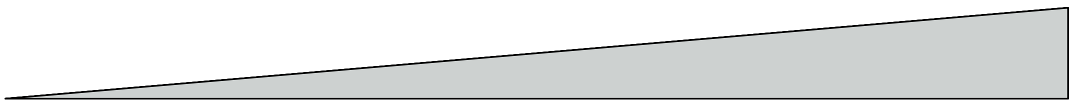
Table 1: Attributes and Levels for the Conjoint-Measurement

Attributes	*Level 1*	*Level 2*	*Description*
Research funding	symbolical incentive	substantial funding	Financial incentives for an active participation within a cluster initiative
Congruence with research focus	peripheral area of research	core area of research	thematic proximity of cluster topics to the current research focus of a professor
Geographic location	university location	international clusters	geographic proximity of the cluster to the researchers´ own location
Reputation	low	high	Possible reputation increase caused by cluster participation

This set of four variables and their two levels of specification lead to a full factorial design of 16 scenarios. Since as many evaluation tasks would overstrain the respondents and reduce the reliability of the results, we systematically reduced the complexity by an orthogonal main effect design consisting of eight scenarios (Hahn & Shapiro, 1966). We included two additional holdout scenarios to account for the predictive validity by a comparison of their actual preference values and their estimated preference values.

Subjects were asked to rate each scenario on a seven point scale. Because a mere quantification of the preference for involvement on a Likert-type scale could be biased by subjectivity, we provided a very specific description of each level of the scale The scale (Figure 1) has been adjusted after discussion with interviewees in the course of the pretest.

Please imagine that you would be asked for active cluster participation by a representative of a local **cluster initiative**. For an **evaluation** of the particular initiative you have no more information than the parameters and their specific levels shown beyond.
The **degree of involvement** in the cluster initiative compasses the following options, where **(1)** stands for the lowest contribution and **(7)** for the highest contribution.



1	2	3	4	5	6	7
no willingness for participation	you deliver a guest lecture about the research topic of the cluster	you take care for a diploma thesis related to the research topic of the cluster	you put an assistant in charge for the research topic of the cluster	you undertake a joint probing project with the cluster	you align an existing project to the requirements of the cluster	you undertake a joint new large-scale project with the cluster

Based on the available information, please evaluate initially, what maximum of **effort** you would put in each of the following fictitious cluster initiatives. If **more than one answer** seems to be adequate please **solely** check that one with the maximum degree of involvement.

Figure 1: 7-Point scale with description

Beside the scenario-ratings, individual characteristics of academics were taken into account to distinguish different types of academics. To measure an academic's long-term orientation, we adapted four items of the scale of Ganesan (1994). Specifically, we asked for the degree of agreement on a five point Likert scale (1 = I do not agree; 5 = I fully agree) regarding the following questions: "I believe that over the long run my cooperation will be profitable", "Maintaining a long-term cooperation is important to me", "I focus on long-term goals in my cooperation", "I am willing to make sacrifices to help my cooperation partners from time to time". The scales received an acceptable Cronbach's alpha score of 0,76.

The quality of research outputs was manually assessed. With this purpose, we collected the online publication lists of each respondent ex-post. To assure for completeness of these lists, an additional search in the online publication database *Science Direct* was performed and missing articles were added manually. To cover the current visibility of a researcher's outputs state we focused on publications in a five year period before the survey collection. Since journal articles are the only valid indicator of research quality (due to the peer-review process (Macri & Sinha, 2006)), we did not consider other kinds of publications such as books, conference proceedings etc. To weight the quality of a journal article, we multiplied each publication with the *5-year Journal Impact Factor (JIF)*. The JIF of the reference year measures the number of received citations by a journal within the past two years divided by the number of articles published (Harris, 2008). The five-year JIF builds an average over a five year period and, thus, fits to the reference period. In case of more than one author we divided the JIF by the number of authors as it is proposed by Davies et al.(2008). The sum of all weighted publications yields the measure for visibility of research outputs.

Sample

To draw our sample, email addresses of academic researchers from the field of engineering and physics from 50 German regionally distributed universities were identified by web research. During a 6 month time period in 2009, the survey was sent to 963 academics. Two weeks after mailing, we followed up by telephone. We received 108 surveys altogether, what corresponds to a return rate of 11.2%. Four of these surveys were manually rejected due to missing values and obviously flawed data. The analysis of predictive relevance, using the holdout measures, was further used to identify respondents with an inconsistent answering behavior. Six respondents showed a mean squared error of nine or greater when predicting the rating by their individual preference function. Those were also excluded from further calculations. Therefore, we finally came up with 98 analyzable surveys. To ensure that non-response bias was not an issue, we conducted a series of t-tests between early and late respondents regarding the overall rating score, the research quality and the long-term orientation. This did not reveal any significant differences among the subsamples.

Results

To analyze the main effects of the cluster attributes, we apply a linear regression analysis on the complete dataset to evaluate the overall preferences of academics. Table 2 shows, that all attributes significantly influence the participation propensity of an academic researcher. Without testing interaction effects, the model explains 43.7% of the variance of the cluster participation propensity. The overall highest part-value (30.1%) is allocated to the cluster parameter "research funding" which indicates that the greatest motivational potential stems from monetary incentives. This shows, that researchers prefer clusters that offer substantial funding compared to those that offer symbolical incentives and proves hypothesis 1. Congruence with the research focus receives a positive part-value of 29.3%. This supports hypothesis 2, as academics are incentivized by the possibility to conduct research close to their core research interest. 24.8% of the utility is allocated to the high reputation of the cluster initiative supporting hypothesis 8. The negative average value of the attribute geographic location (-15.7%) indicates that clusters located at the university location (level 1) are generally preferred. Thus, distance from the university location reduces the participation propensity. Although this is less important compared to other dimensions, academic researchers prefer clusters in spatial proximity and hypothesis 9 is confirmed by the data as well.

Table 2: Effects of cluster attributes on the overall cluster participation propensity

Attribute	Model 1 Normalized part-value[1]	Beta	Standard error	Model 2 Normalized part-value[1]	Beta	Standard error
Intercept		1.911	.114		1.485	.158
Research funding	0.301***	1.449	0.099	0.277***	1.492	.102
Congruence with research focus	0.293***	1.408	0.099	0.261***	1.408	.098
Geographic location	-0.157***	-0.755	0.114	-0.115***	-.620	.117
Reputation	0.248***	1.194	0.099	0.222***	1.194	.098
Congruence with research focus*Research funding				0.079***	.428	.102
Congruence with research focus*Reputation				0.012	.066	.098
Congruence with research focus*Geographic location				0.033	.179	.117
R^2	0.437			.451		
F	150.9			91.1		

[1] Part-values are positive if variable level 2 is preffered; otherwise they are negative
*** p<0,001; ** p<0,001; * p< 0,05

The second model includes the interaction effects of cluster attributes. The model indicates just one interaction effect between the variables. We find an interaction effect between the research funding and the congruence of the cluster research focus with the one of the academic researcher. Although we did not explicitly state hypotheses on interaction effects, this is an interesting finding. As Figure 3 shows, this effect indicates that if the cluster conducts research in the core research area of the academic, the relevance of substantial incentivation further increases. This result speaks against the prominent arguments of a crowding out effect of intrinsic motivation by extrinsic incentives (Reeson & Tisdell, 2008). However, this finding sheds some light on the underlying motivational paradigm of academics when it comes to cooperation with industry clusters. If academics offer cooperative research in the core area of their research, their expertise will be especially high. Thus, it is likely that they consider themselves as specialists and expect a higher monetary payback of the participation.

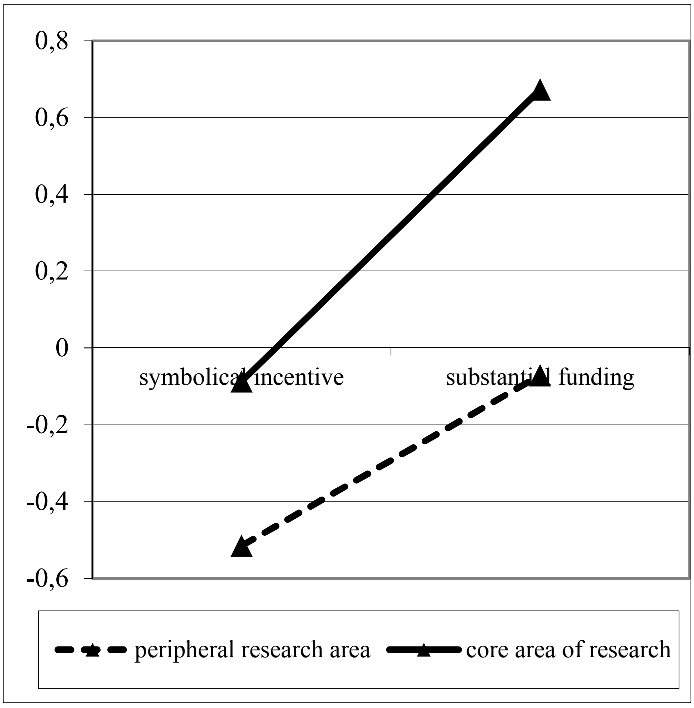


Figure 3: Interaction between funding and congruence with research focus

In the next step, we investigate whether specific cluster design parameters attract different groups of academics. For testing those hypotheses including contingency effects, we examined particular cluster parameters in combination with personal attributes. Therefore, we median-split the dataset based on the degrees of research visibility and long-term orientation into two groups each. Those groups were then used for estimation of the utility functions allocated to single cluster parameters on the group level. We calculated pairwise t-tests preferences of each group in order to test the significance of the mean differences (delta). Table 3 shows the results of the comparison of the part-values of academics with a low visibility of research compared to those who have a high quality research output. Besides the testing of our hypothesis, the significant difference of the intercepts of the regression function indicates, that the general propensity to participate in a local cluster initiative deviates. This shows that, in general, researchers with a high visibility of research are less willing (1.61) to allocate their time towards industry projects than researchers with a lower research output (2.21). We find that those researchers with a high visibility of research have a significantly higher relative preference for research funding (34.8%) than those with a low visibility (24.8%). This effect gives support to hypothesis 2. Hence, in line with our argumentation, academics conducting high quality research expect higher financial returns from their engagement for industrial research. However, we did not find significant effects for the differences of preferences for other cluster attributes. Hence, the hypotheses 7 and 9 have to be rejected.

Table 3: Effects for researchers with low compared to high research visibility

	Low visibility (n=50)			high visibility (n=48)				
Attribute	Normalized part-value[1]	Beta	Standard error	Normalized part-value[1]	Beta	Standard error	Delta	t-value
Intercept		2,205	,167		1,608	,154	0,596**	2,649
Research funding	0,248***	1,095	,144	0,348***	1,818	,134	0,723***	3,703
Congruence with research focus	0,312***	1,375	,144	0,276***	1,443	,134	0,068	0,347
Geographic location	-0,192***	-0,849	,168	-0,127***	-0,665	0,151	0,185	0,824
Reputation	0,248***	1,095	,144	0,248***	1,297	,134	0,202	1,034
R^2	0,378	4,414		0,546			0,168	
F	33,964			64,531			30,567	

Note: *** p<0,001; ** p<0,001; * p< 0,05

Table 4 contrasts the effects of academics characterized by a short-term orientation and those with a long-term orientation. In line with the remaining hypotheses 3 and 5, we find significant differences between the group preferences regarding research funding and geographic location. Those academics aiming for short-term cooperation do rely to a higher degree on monetary incentives (32.9%) than those who seek for long-term gains (25.0%). Also, if academics are oriented towards short-term bargains, this goes along with a higher preference for clusters in spatial proximity (19.2%). However, the detrimental effect of an international cluster location significantly lowers if researches engage in the long run (-12.7%).

Table 4: Effects for researchers with short-term compared to long-term orientation

Attribute	Short-term orientation (n=63) Normalized part-value[1]	Beta	Standard error	Long-term orientation (n=35) Normalized part-value[1]	Beta	Standard error	Delta	t-value
Intercept		1,79	0,139		2,129	0,195	0,339	1,450
Research funding	0,329***	1,603	0,12	0,250***	1,171	0,17	0,432*	2,131
Congruence with research focu	0,257***	1,254	0,12	0,360***	1,686	0,17	0,432	0,562
Geographic location	-0,165***	-0,803	0,139	-0,144***	-0,673	0,191	0,130*	2,131
Reputation	0,249***	1,214	0,12	0,247***	1,157	0,17	0,057	0,282
R^2	0,459			0,428			0,031	
F	105,716			51,399			54,317	

Note: *** p<0,001; ** p<0,001; * p< 0,05

Discussion

The investigation of different cluster settings above shows some valuable insights into the underlying motivational potentials of regional clusters for the incentivation of academic researchers. We were able to confirm seven of nine hypotheses regarding the motivational potential of cluster attributes for different kinds of professors. The most interesting finding of our study is that "valuable" academics whose contributions are highly visible in international academic community can be primarily motivated for working in clusters by high monetary incentives. This is even then true if the cluster offers a research focus in line with the core area of research of the academic. We find an unexpected interaction effect of research funding and the congruence of the cluster research with the core interest of the academic. Hence, if those researchers who are specialists for the cluster purpose should be motivated to contribute to an industrial cluster, they predominantly require monetary offers. Furthermore, the general participation propensity of high quality researchers falls behind the propensity of those who are less visible in the international scientific community. A potential threat for the cluster management arises, as research funding especially motivates short-term oriented researchers. Academics prefer clusters in regional proximity as compared to international cooperation. Hence, it is questionable whether clusters can stimulate engagement of international star scientists. Although this effect decreases if the academic researcher is long-term oriented, it does not depend on the researcher's visibility. Reputation of the cluster members motivates other academic researchers to join. Overall, the data show, that the motivational factors which drive a high quality academic researcher to take part in an industrial cluster are highly extrinsically oriented. This indicates that if a star scientist decides to engage in industry projects, he or she mainly takes the role of an entrepreneurial scientist (Lam, 2010) as compared to the traditional view that mainly regards academic researchers as being intrinsically motivated.

The design of cluster policies is a rather complex endeavor according to the general dilemma between collaboration propensity and quality of research inputs. Interaction between motivational factors leads to thwarting effects and, thus, undermines singular advantages. Our research can contribute to the understanding of the effects of cluster parameters. From a practical perspective, study findings reveal settings of clusters which provide optimal incentives for the participation of academics. By that, we follow the suggestion of Lee (1998): "(…) it is important that policy-makers know whether academics are fully on board, and under what terms and conditions they may collaborate productively with industry." In this way, cluster initiators can be enabled to design future clusters in a way that maximizes the willingness of "right" academics to participate.

As usual, our study is not without limitations. First, our empirical study is based on a limited sample size of only 104 academic researchers. Although, some preferences differ absolutely, we solely find a few differences for those between the groups. As the high standard errors of the groupwise utility functions indicate, the residual heterogeneity within the groups might be high. Overall, we suggest an extension of the sample to find more stable group specific effects. Further, this could be used for a latent class segmentation based on the individual utility functions. A second point arises from focusing on German university sector. As in an international context the pressure to obtain third party funding might be significantly higher than in Germany, the general propensity to engage for industry projects might be skewed internationally. Therefore, especially a comparative study with researchers from, for example, the United States would be an insightful endeavor. Third, relevant dimensions were deduced by an extensive literature research but could miss some additional aspects. For instance, additional individual factors could be revealed by additional in-depth interviews.

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