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CO-PRODUCTION OF VALUE ADDED FROM INCUBATION: EXAMINING THE ROLE OF DYADIC AND TRIADIC RELATIONSHIPS

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Abstract

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KEYWORDS:

Incubator co-production incubation value added Norway

1. Introduction

Governments and public actors in industrialized as well as developing countries and regions, have over the last decades established and promoted incubators as a policy tool to nurture the development of entrepreneurial firms, technology based and growth oriented ventures in particular (Hackett and Dilts, 2004b). However, the impact of these incubator programs are increasingly debated. While some studies find that incubated firms show performance advantages compared to non-incubated ventures (e.g. Colombo and Delmastro, 2002), indicating that the incubation process adds value to incubated firms. Other studies find no such systematic differences between incubated and non-incubated ventures (e.g. Lindelöf and Löfsten, 2003; Westhead, 1997), or that identified advantages are not sustainable (Amezcuca et al., 2013).

Reflecting this variety of results, Barbero et al. (2012:888) argue that the “Literature is inconclusive as we can find results supporting both claims: the value added of the incubators and those that claim that they provide little value”. These inconsistencies have been ascribed to the lack of theory and analytical models to guide empirical analyses of incubators (Barbero et al., 2012), and to a limited understanding of the mechanisms through which incubators potentially add value to incubated firms (Aaboen, 2009). The idiosyncratic and a-theoretical nature of the literature has made it difficult to develop cumulative insight across studies about how incubators best can assist the development of client firms (Ahmad, 2014). Moreover, most studies have taken the perspective of the incubator or the policy maker when assessing effects of incubator services (supply side perspective). There is scarcity of research looking into incubators from the perspective of the firms (demand side perspective) (Aaboen, 2009; Bruneel et al., 2012; McAdam and McAdam, 2008).

The purpose of this paper is to help recast this research issue by shifting the focus from whether or not incubators add value to examine the relationships and mechanisms through which value added from incubation is created. Drawing on recent theorizing on co-production (Rice, 2002; Scillitoe and Chakrabarti, 2009), the paper develops an analytical

model highlighting how value added from incubation may be created in co-productive dyadic and triadic relationships between incubator managers and their client firms (also referred to as incubatees). The following research question is addressed: How are value added from incubation created in co-production relationships between incubator managers and client firms? The research question is elaborated into eight hypotheses that will be tested against empirical survey data gathered from clients in Norwegian incubators.

The paper seeks to contribute to the literature in at least three ways: First, we extend previous literature by shifting the focus from whether or not incubators add value, to how and under which circumstances this added value is created in the relationship between incubators and incubated firms. Second, in doing so we examine the empirical relevance of co-production theorizing which has recently been advanced for understanding how incubators create outputs (Rice, 2002; Scillitoe and Chakrabarti, 2009). This theorizing postulate that value added from incubation is created in *relationships* between incubators and their tenant firms (Rice, 2002). Identifying key dyadic and triadic relationships in the incubation process, we examine and test the empirical relevance of this theorizing.

A third and related contribution is that we extend the literature on incubators by conducting a quantitative micro-based study of how incubators actually add value. Prior research on this issue has mainly been case studies conducted at the incubator level (see Barbero et al., 2012; Hackett and Dilts, 2004b for a review). Far fewer studies have offered a firm level perspective on how incubators add value seen also from the perspective of incubator firms (Scillitoe and Chakrabarti, 2009).

Further, this research may have important contributions also for policymakers and practitioners, as a shift in focus towards how value added is created in relationships during the incubation process has the potential to increase the understanding of how incubators best can stimulate the development of incubator firms and, hence, be implemented to create stronger positive effects from the incubator.

This paper proceeds as follows: First, we briefly account for previous literature on effects of incubators, and thereafter develop an analytical model highlighting how value added from incubation may be created in co-productive dyadic and triadic relationships between incubator managers and affiliated incubatees. Second, the empirical study of 160 incubated firms in Norway is reported on. Third, regression models are used to test the empirical relevance of the hypothesized relationships. Finally, results and implications of the study are discussed.

2. Theoretical background and prior research

Policymakers, practitioners and academics have long recognized that small and young firms face many challenges related to financial constraints, financial market imperfections, and imperfect competition that impede the successful development of new entrepreneurial ventures (von Zedtwitz and Grimaldi, 2006). Many public programs and policies, including incubator programs, have been established in order to assist and support new entrepreneurial ventures to overcome such market imperfections (Hackett and Dilts, 2004b; Phan et al., 2005). By providing unique resources and support aimed at helping the development of new entrepreneurial ventures, incubators are supposed to add value to increase the chances of innovation, growth and long-term survival of the incubated firms (McAdam and McAdam, 2008).

A relatively large literature has been devoted to the issue of whether or not such public programs and policies have been efficient. Prior studies have usually concentrated on examining the value added of being located in incubators by comparing firms located within incubators to a control group of firms located outside such 'sheltered environments'.

Table 1 gives an overview over some of the most central studies in this area. It is apparent that the results are rather inconclusive about the extent to which incubators really add value. While examining a broad range of performance indicators and a large variety of geographic contexts, research have failed to find any consistent results relating to the impact of incubators. Common to most of this research is that they have examined 'whether or not' incubators add value to incubated firms by comparing incubated to non-incubated

firms and focused on average differences between the two groups. While such analyses are both interesting and necessary, they do not reveal knowledge about the mechanisms through which incubators can add value to incubated firms and help foster their development and reveal little as to “how the incubator should be managed and organized in order to achieve this end” (Aaboen, 2009:657). Thus, recent research and reviews of the literature question the relevance of the dominant and very empirical oriented control-group approach to the study of the effectiveness of incubators.

Table 1 Overview over key studies on effects of incubators

STUDY	METHOD	OUTCOME MEASURE(S)	KEY FINDINGS
Mian (1996)	Multiple case design of 6 incubators and survey of 47 incubated firms. USA	Subjective measures on value added contribution as perceived by respondents.	Incubation adds value as perceived by managers in incubated firms through a combination of university-related input and other types of incubator services.
Westhead (1997)	Survey of 284 NTBFs, 183 on-site and 101 off-site in Science parks, follow up data 8 years later, new sample of 110 NTBFs on assisted and non-assisted science parks. UK	Innovativeness measures	No significant differences between NTBFs located in a Science Park and firms located outside a science park on a variety of innovativeness measures
Löfsten and Lindelöf (2001)	Survey of 263 NTBFs; 163 located on-site in science parks, 100 located off-site. Sweden	Growth in sales, growth in employees, and profitability.	Science parks had positive impact on sales and employment growth. No effect of science park location on profitability.
Colombo & Delmastro (2002)	Survey of 45 NTBFs in a technology incubator and matched control sample of 45 off-incubator firms. Descriptive and bivariate analyses. Italy	Innovative activity measures Growth rate Technology adoption International R&D collaboration	Input and output measures of innovative activity are only marginally different between on- and off-incubator firms. Incubated firms performed better than non-incubated firms in terms of growth rate, adoption of advanced technologies and international R&D collaboration
Lindelöf and Löfsten (2003)	Survey of 273 NTBFs; 136 located in a science park, 139 not on a park site, descriptive and bivariate analyses. Sweden	Subjective measures on market value, profit margin, cash flow, profit compared to competitors Patents/product launches.	No significant differences between on- and off park firms in terms of performance measures or patents/product launches. On- and off-park firms varied in motivations of location and strategy issues, but not in a clear pattern. On-park firms tend to collaborate less than off-park firms.
Fukugawa (2006)	Data from 74 owner-managed NTBFs located on- and off science parks, 31 NTBFs located in incubation centers, 34 NTBFs located in industrial parks. Japan.	R&D cooperation	NTBFs located within a science park were more inclined to enter into R&D cooperation compared to off-park firms, no significant differences were found between science parks and other types of property-based initiatives.
Rothaermel and Thursby (2005a)	Longitudinal survey data from 79 incubated, annual surveys over a 6 year period, multinomial logit regression analyses. Supplemented with semi-structured interviews. USA	Whether the firm graduated, failed or remained in the incubator	Firms licensing technology are less likely to fail outright than firms not licensing technology. Additionally, firms with a professor as part of the top-management team are less likely to graduate from the incubator in a timely fashion.
Squicciarini (2009)	Survey of 252 firms located in a science park. Finland	Patenting activity	Patenting activity increased after science park location and in particular the science park incubator had a large positive effect on the innovative performance of young firms
Scillitoe and Chakrabarti (2009)	Survey of 42 NTBFs in incubators, bivariate analyses and multivariate regression analyses. Finland and USA	Business assistance Technical assistance	Entrepreneurs get the best business assistance from counseling interaction with incubator management, and the best technical assistance from the network interaction provided by the incubator.
Yang et al (2009)	Panel data for 247 NTBFs, whereof 57 were located in a science park.	Elasticity of R&D	Elasticity of R&D with respect to outputs of NTBFs located within the science park was significantly higher than that of off-park firms
Salvador (2011)	Survey of 20 university spin-offs in incubator and control sample of 91 non-incubated firms, and register data on financial accounts. Multivariate regression analyses. Italy	Added value based on financial accounts	Firms in incubators were found to have a lower added value compared to the control group.
Lundqvist (2014)	Public revenue data from 170 Swedish ventures located in incubators (35 % with surrogate entrepreneurs). Data is supplemented with a case study of one incubator. Sweden.	Revenue and revenue growth	Incubated firms for which the incubator has provided a surrogate entrepreneur perform significantly better in terms of growth and revenue compared to non-surrogates.

2.1 Towards a theory based approach

Scholars have increasingly called for theory guided analysis of incubator effectiveness that are pay full homage to the key process having the potential to generate output, namely the incubation process. The underlying idea of incubators is that they can add value by exposing incubated firms to an incubation process. However, a central feature of the literature has been “incubator configuration studies” describing and comparing incubators, with little or no focus on client firms and the processes of incubation they are exposed to. Prior research of this type has explicitly or implicitly assumed that variation in terms of output across incubators can be ascribed to the variance between different incubator archetypes (Barbero et al., 2014; Barbero et al., 2012).

Thus, the key overall mechanism underlying the incubator concept, the incubation process, is still poorly understood, especially seen from the perspective of the client firm (Aaboen, 2009). It has therefore been argued that more research is needed on incubation outcomes seen in relation to “how different incubators organise and manage their incubation processes” (Bergek and Norrman, 2008:21). Consequently, recent calls have been made for more research to open up the ‘black box’ of the incubation process and its relationship with performance. For instance, Hackett & Dilts (2004b:74) argue that:

“Indeed, for our understanding of the incubator-incubation phenomenon to advance, we will need to unpack the variables associated with the incubation process and then use these variables to build, validate and test incubation process models that help predict and explain clearly defined business incubation outcomes. Focusing on the process of incubation [...] will draw attention to the underlying causes of new venture development in an incubator-incubation environment.”

Linked to the above, theories that can explain the incubation process and its outcomes are lacking. While scholars have put forth traditional theories like the resource based view (Barney, 1991) (see Hackett & Dilts for a review), these theories do not do full justice to the complexities of the incubation process, as they are derived on the basis of premises incompatible with the nature of the incubation process, and/or designed to explain different issues than incubation (Ahmad, 2014; Ahmad & Single, 2014). Arguably, there is one exception to this, namely theorizing on co-production which explicitly seeks to understand the incubation and its associated outputs.

Originally put forth by Rice (2002) in the incubator context and developed further by others (e.g. Patton, 2014, Patton and Marlow, 2011, Scillitoe and Chakrabarti, 2009), the basic premise of this theorizing is that outputs and value added from incubation are co-produced in the interaction between the incubator manager and the client firms. Output is co-produced in dyadic and triadic relationships among these actors: (1) Between incubator managers and their client firms and (2) between client firms and (3) relationships in which incubator managers facilitate the interaction between clients. One of the key insights from co-production theorizing is that for incubators to have positive output and companies to have value added from incubation, neither incubator firms, nor incubator managers, can be passive actors. On the contrary, “co-production involves joint efforts between two parties, who jointly determine the output of their collaboration” (Rice, 2002: 165). Theorizing on co-production in the context of incubation has been mainly conceptual and/or qualitative exploratory research. Verification and further development of this theorizing through empirical testing has been scarce.

To quantitatively examine the empirical relevance of the co-production perspective in explaining and understanding the incubation process and its value added, we develop, based on the literature, an analytical model highlighting how value added from incubation may be created in co-productive dyadic and triadic relationships between incubator managers and their client firms. The model is sketched below and elaborated in the next sections accompanied by testable hypotheses.

2.2 Client demand

According to co-production theorizing an important factor forming the extent to which incubators have output is the readiness of the entrepreneurs to engage in co-productive relationships (Rice, 2002). It is argued that: “the efforts of the consumer are central to the production of the output. The producer alone cannot determine the quality or the quantity of the output” (p. 165). The general idea behind incubators is that incubator managers possess competencies and skills that could benefit clients. As Rice (2002, p. 175) argues: “the *raison d’être* of business incubation is to allow entrepreneurs to take advantage of the greater knowledge and experience of the incubator manager” . However, knowledge and

insight do not flow effortlessly from the incubator manager to the client. While incubator managers have a clear responsibility for organizing the incubation process in a way in which incubatees and incubator manager interact, also the incubatee has a clear role to play: Incubatees need to be ready and motivated for interaction in order to take advantage of the competencies of the incubator managers (Rice, 2002). Arguably, such readiness can be conceptualized in many ways. We have chosen to conceptualize readiness in terms of demand for knowledge and resources, precisely what most clients lack and which is a key rationale of incubators to provide. Thus, it is expected that client demand for knowledge and resources is a key motivation factor lying beneath the interaction pattern between the client and the incubator manager. Hence, the following hypothesis is suggested:

H1a: There is a positive relationship between incubatees' demand for knowledge & resources and interaction with incubator manager

In similar vein, it is suggested that clients' demand for resources and knowledge will lead them to make use of the services offered by the incubator in which they are affiliated. The following hypothesis reflect this:

H1b: There is a positive relationship between incubatees' demand and use of services from the incubator

A key mechanism and type of relationship creating output from incubation is the relationship between clients in the same incubator. Recent studies highlight the importance of client co-location. Apart from facilitating tangible economic activities, as when client firms are each other's customers and/or work together to win contracts, co-location can also create informal networking activities, allowing clients to be familiarized with each other. This may lead to intangible advantages such as the formation of social networks supporting sharing of knowledge, resources, advice and insight across clients within the same incubator (McAdam and McAdam, 2006). However, such informal networks do not arise by themselves, but needs to be developed and sustained by the actors involved. For the focal

firm it is hypothesized that it will be more motivated for such interaction when experiencing higher demand for knowledge and resources. It is therefore expected that:

H1C: There is a positive relationship between incubatees' demand and interaction with other incubatees

2.3 Client-incubator manager-client relationship: A triadic relationship

Recent theorizing extends Rices (2002) focus on dyadic relationships between the client and incubator manager. Ahmad & Single (2011) suggests, on the basis of a qualitative case study, that triadic relationships are also important for value-creation in incubators. This is a type of relationship in which the incubator manger facilitate interaction and exchange of resources and insight across clients. The importance of such relationships has also been highlighted in previous research where the role of the incubator has been conceptualized as an intermediating third party within the incubators, facilitating interaction between clients and sharing of resources and knowledge within the incubator (Hughes et al., 2007; Bøllingtoft and Ulhøi, 2005). Reflecting this, the following hypothesis is put forth:

H2: For the incubatee, there is a positive relationship between interaction with incubator manager and interaction with other incubatees

2.4 Relationships and their value added

A key point in co-production theorizing is that value added from incubation is created in relationships (Rice, 2002; Ahmad & Single, 2011; Ahmad; 2014). When discussing outputs generated by incubators in the context of co-production theorizing, Rice (2002) argues that: "if the incubator manager provides nothing, there is no co-production" (p. 181). The role of the incubator manager and his or her interaction with incubatees therefore play a crucial role in generating impacts from incubation in co-production theory. Reflecting this, it is argued that: "To achieve greater impact, the incubator should be structured, staffed, and financed in such a way as to maximize the time of the incubator manager available for co-

production activities” (Rice, 2002, p.181). Based on this crucial aspect, the following hypothesis is suggested:

H5: There is a positive relationship between interaction with incubator manager and value added from incubation

However, the client also have a crucial role to play in the generation of incubator output from co-productive relationships: “if the entrepreneur [client] refuses to engage, there is no co-production” (Rice, p. 181). Thus, the efforts of the incubatee is central to the production of incubator output. The producer alone cannot determine the quality or the quantity of the output (Parks et al., 1981). Reflecting the key insight that incubatees need to use services offered by the incubator in which that are a part of to experience value added from incubation, the following hypothesis is put forth:

H6: There is a positive relationship between use of incubator services and value added from incubation

The incubator manager is not the only one providing the focal client with resources, advice and important insight. As already noted, interaction between fellow incubatees is believed to be a crucial mechanism generating positive incubation output (Ahmad & Single, 2011; Ahmad, 2014). The following hypothesis reflect how value added from incubation for the focal firm is produced in interaction with fellow clients:

H7: There is a positive relationship between interactions with other incubatees and value added from incubation

2.5 Initial firm development and value added from incubation

Incubators can only add value to incubated firms if their services are responding to some sort of need by the incubated firms. Consequently, selection strategies of incubators have been put forward as an important factor explaining value-added contributions (Aerts et al., 2007; Hackett and Dilts, 2004a). Incubators can choose different selection strategies (Bruneel et al., 2012; Clarysse et al., 2005). They therefore vary in terms of the

characteristics and life cycle stages of their tenant firms; variations which have been found to be related to firms' demand for services from the incubator (Bruneel et al., 2012; Chan and Lau, 2005; McAdam and McAdam, 2008). A key issue in this regard is that nascent firms need a larger variety of services compared to established firms, and hence incubators selecting nascent firms may add more value by providing these services compared to those addressing young or older firms (Bruneel et al., 2012).

The effects of the incubation process and the above hypothesized relationships on value added from incubation may therefore be expected to be reduced when client firms are relatively developed before admittance into the incubator. It is hypothesized that when such firms are admitted into the incubator, the above hypothesized relationships have less "material to work with" and thereby the value added created in relationships during incubation will be reduced. The following hypothesis reflect this:

H8: There is a negative relationship between level of firm development before admittance to the incubator and value added from incubation

3. Method and measures

3.1 Research context

Data was gathered in the context of a large research project on incubators initiated by the Industrial Development Corporation of Norway (SIVA), a public agency which supports incubators in Norway. At the time of this study, SIVA supported 36 incubators through incubator programs in cooperation with sponsors from the private sector and other governmental agencies; one program on R&D incubators and one program on industry incubators. SIVA seeks to create, invest in and manage the innovation environment in Norway. Incubator programs are part of their efforts in this respect. The aim is to stimulate to new growth businesses by giving access to professional business developers, capital and networks. Supporting innovation and market implementation is central parts of these programs.

Preceding the research project from which results are reported in this paper, the authors have been involved in practitioner evaluations of the SIVA supported incubator programs. The research project build on these projects where in total 17 interviews with incubatees and 16 interviews with incubator managers have been conducted, providing comprehensive background information about the two types of incubators and how they operate. Further, the survey was pre-tested in February 2013 among 49 incubator firms. The face validity of the survey design, including the questions, was tested in a seminar where 5 incubator managers participated. All incubator managers thought the survey was highly relevant. Based on the understanding gained through the project, including interviews and feedback from incubator managers/firms, and reading of the incubator literature, an e-mail survey was developed and distributed to the CEOs of all start-up firms in the incubators.

3.2 Survey data

A list of all firms in SIVA supported incubators including names and e-mail address of the CEOs was provided by the public agency SIVA. Further, all incubator managers were asked to help motivate incubatees to respond to the e-mail survey. After two reminders, we ended up with 166 responses out of a population of 400 incubator firms. This constitutes a response rate of about 41 %. Since some firms did not receive all the questions used in the e-mail survey the sample size drops to 145 in this paper.

3.3 Dependent variables: Value added contributions

The overall dependent variable in focus in this study is the value added from being located in an incubator seen from the perspective of the incubatees. In line with the objective of incubators, which is to foster the development of innovative high-growth firms, we focused on two key dimensions of incubator value added: Innovation value added and market value added. The importance for technology oriented firms to quickly introduce products onto the market to generate

a cash-flow to sustain further firm development (e.g. Schoonhoven et al, 1990; Clausen & Korneliussen, 2011) and the importance for incubator firms to be market oriented and learn from customers (Amezcuca et al, 2013), are both highlighted in the literature and reflects the view that a key aspect of the incubation process is to accelerate the development of new entrepreneurial ventures.

Innovation value added is a latent construct measured by three questions. Respondents could indicate their agreement with the following Likert scale questions on a scale from 1 (Completely disagree) to 7 (Completely agree): “The environment in the incubator has made my firm to invest *more time* working with the introduction of new products/services on the market”, “The environment in the incubator has made my firm to invest *more resources* in the introduction of new products/services on the market ” and “The environment in the incubator has enabled my firm to *more quickly* start the work to introduce products/services on the market”. The measure of innovation value added reflects a view of innovation as the market introduction of new products and technology (e.g. Schumpeter, 1934) and the role of the incubator in accelerating this process. Cronbach’s alpha for innovation value-added is 0.90.

Market value-added is a latent construct measured by four questions. Respondents could indicate their agreement with the following Likert scale questions on a scale from 1 (Completely disagree) to 7 (Completely agree): “The environment in the incubator has ensured that firm has been in a better position to obtain *first sale quicker*”, “The environment in the incubator has ensured that my firm has spent *more time* identifying customers/market segments”, “The environment in the incubator has ensured that my firm has invested *more resources* in identifying customers/market segments “, and “The environment in the incubator has enabled my firm to more quickly get in touch with new customers/markets”. The measure of market value added reflects a view of new firm development

where it is important for firms to be quick to market, to learn from customers and their insight as early as possible, stressing that a clear danger for incubator firms is to hide in the incubator and not learn from the market (Amezcuca et al, 2013). As such, it reflects the current emphasis in the literature on lean start-up methodologies where as early as possible market feedback and experimentation based on client insight are key parts of an accelerated new venture development process. Cronbach's alpha for the market value-added is 0.89.

3.4 Key explanatory variables

Rice (2002) highlights that client readiness is key to incubator performance. In line with recent focus on the demand side in the entrepreneurship literature (xxx), we focus on a measurement of clients readiness which highlight clients demand for knowledge, resources and competencies: The variable '*demand*' is a summated scale consisting of a series of sub-questions about the extent to which incubator firms have had the need for different types of resources, including competence and knowledge after they were admitted into the incubator. The questions were preceded by the following introductory text: "Have your firm been in need of the following types of services after your firm became an incubator firm?" Respondents could state their agreement on a scale from 1 to 7 about the extent to which their firm had demanded such input on the following categories: "assistance with new product development", "advice and counseling about the introduction of new products in the market", "business development support (e.g. business planning, idea development)", "organizational development support (e.g. recruitment, resource acquisition)", "mentoring and coaching", "network support (e.g. to researchers, R&D institutions and relevant industrial partners)", "financing services (e.g. contact with bank or public support agencies)", "equity financing services (e.g. introduction to potential new owners, investors or venture capitalists)", "judicial advice (e.g. IPR, lawyer support)", "marketing advice", "access to administrative services"

Accordingly, the variable 'use' is a summated scale consisting of a series of yes /no questions about whether or not incubator firms use different types of services offered by their incubator. The questions were preceded by the following introductory text: "Do your incubator offer the following types of services: Respondents could state the answers "yes, and we use/have used service", "yes, but we have not used service", "no" and "don't know" on the same categories as presented for the demand variable above. The variable 'use' counts the number of times a respondent answer "yes, and use/have used". It ranges from 0 (none of the above mentioned services are used) and 11 (all services are used).

The variable *incubator manger interaction* measures how often the client and the incubator manager meet: The following question was asked: How often do you have a meeting with incubator managers to discuss the development of your firm? Response options were the following: (1) not had a meeting, (2) 1 time per year, (3) 2-3 times per year, (4) 4-5 times per year, (5) 6-8 times per year, (6) 9-12 times per year, (7) more than 12 times per year.

Client interaction is a summated variable measuring the extent to which the focal firm interacts with other clients in the same incubator. Respondents were asked to state their agreement with a series of questions about this using a 7 point scale where (1) is completely disagree and 7 is completely agree: "firms in the incubator exchange information", "firms in the incubator help each other", "in our incubator firms give each other access to resources and knowledge", "my firm has gained access to external contacts and collaboration partners through other incubator firms", "my firm has gotten access to information and knowledge through other firms in the same incubator", "the firm discuss strategic issues with other firms in the same incubator", "It is often the case that what one incubator firm learn is spread to the other firms in the same incubator", "firms in the incubator support each other". Cronbach's alpha is 0.93. *Initial firm development* before admittance into the incubator was

measured by the following questions, inspired by the literature on gestation activities in the development of firms (Gartner & Carter, 1994). The variable is introduced to measure whether or not the incubator selected less – or more – developed new firms for incubation. To measure it, the following question was asked: “Did any of the following activities take place before the firm became incubated?” Respondent could indicate a yes answer to all of the following “We had prepared a business plan”, “We had registered the firm in the business register”, “We had been in contact with possible clients/customers”, “We had been in contact with possible suppliers”, “We had developed a prototype/sketch for a product/service”, “We had developed a service or product”, “One or more persons (besides the founders) had been hired”, and “At least one of the founders worked full-time in the firm”.

3.5 Control variables

Three variables are entered as control variables. First, *firm age* measures the number of years since the formal registration of the firm in the Norwegian business register. Team equals “1” if the firm is a team start-up, and “0” otherwise. *Prior experience* is a summated scale measuring prior experience and competence of the founders. Respondents were asked to indicate their agreement with a set of statements on a 7 point scale. At least one of the founders has: “education at the masters level”, “prior work experience from the industry”, “previously established and owned a firm”, “management experience from another organization”, “experience with financing of firms”, “experience with investors”, “experience in obtaining external capital”. Cronbach’s alpha is 0,79.

Descriptive statistics for all included variables are presented in Table 1.

Table 1 Descriptive statistics

	N	Min.	Max.	Mean	Std. Dev.
Age	147	.00	12.00	3.2041	3.47582
Prior experience	145	1.00	7.00	4.6726	1.69660
Use	147	.00	11.00	5.3061	2.89925
Incubator manager interaction	146	1	7	4.55	1.770
Client interaction	145	1.00	7.00	3.5046	1.68997
Initial firm development	139	1.00	8.00	4.6763	2.03312
Team	147	.00	1.00	.7007	.45953
Innovation value added	145	1.00	7.00	3.8218	1.72710
Market value added	145	1.00	7.00	3.6098	1.78124

4. Results and testing of hypotheses

Tables 2 to 5 below documents results from a series of OLS regression analyses where the hypotheses have been tested.

Table 2 reports on regression analyses on how demand is related to interaction with incubator manager, use of incubator services and interaction with other clients: The results clearly suggest that demand has a positive and significant relationship with “incubator manger interaction”, “use of services” and “client interaction”. These results lend empirical support to hypotheses 1A, 1B and 1C. Hence, client readiness, conceptualized as the demand for knowledge and resources, is a key driving force behind the number of times incubatees meet their incubator manager, how many times of incubator services that are used, and the extent of interaction with the other incubatees in the same incubator. Client demand is thus a key mechanism fostering dyadic interaction and relationships within the incubators studied.

Table 2 Linear regression models – interaction and use of services (H1A,B,C)

	Incubator manager interaction	Use of incubator services	Client interaction
	Beta	Beta	Beta
Age	-,141	-,076	,132
Prior experience	-,058	-,118	-,137
Demand	,297***	,329***	,432***
Initial development	,014	-,193**	,104
Team	-,166*	-,038	,046
N	136	136	136
R2	14%	23%	22%

*Sig at the 0.1 level ** Sig at the 0.05 level *** Sig at the 0.01 level

Results in table 3 shed light over how triadic relationships and interaction is fostered: Results show that incubator manager interaction (where the client and the incubator manger discuss) is positively and significantly related to the focal client’s interaction with fellow incubatees. This lend empirical support to hypotheses 2. Hence, the incubator manger has a key role in creating triadic interaction and relationships between clients in the incubators studied.

Table 3 Linear regression model – client interaction

	Client interaction
	Beta
Age	,225**
Prior experience	-,131
Incubator manager interaction	,338***
Initial firm development	,005
Team	,125
N	136
R2	16 %

*Sig at the 0.1 level ** Sig at the 0.05 level *** Sig at the 0.01 level

Results in table 4 and 5 analyze the extent to which dyadic and triadic relationships and interaction patterns create value added from incubation. Results in table 4 and 5 show that innovation and market value added from incubation is created when the focal client (a) interacts with the incubator manager to a higher extent, (b) use services offered by the incubator and (c) interacts with other firms in the same incubator. These results lend empirical support to hypotheses 5,6 and 7.

Results in tables 4 and 5 also shed light over how initial firm development influence value added from incubation: In table 4 and 5 it can be seen that initial level of firm development before admittance in the incubator has a strong negative and significant relationship with both innovation

and market value added from incubation. These results lend empirical support to hypothesis 8. Relationships and interaction patterns within the incubator will to a substantially lesser extent create value added from incubation with firms admitted into the incubator have a higher development level.

Table 2 Linear regression models – innovation value added

	Model 1	Model 2	Model 3	Model 4
	Beta	Beta	Beta	Beta
Age	,284***	,169**	,258***	,222***
Prior experience	,175**	,216***	,210***	,238***
Incubator manager interaction	,336***			,116
Initial firm development	-,485***	-,502***	-,391***	-,415***
Team	-,033	-,115	-,087	-,076
Client interaction		,420***		,259***
Use			,440***	,268***
N	135	135	136	135
R2	30%	36%	37%	44%

*Sig at the 0.1 level

** Sig at the 0.05 level

*** Sig at the 0.01 level

Table 5 Linear regression models – market value added

	Model 1	Model 2	Model 3	Model 4
	Beta	Beta	Beta	Beta
Age	,146*	,015	,114	,088
Prior experience	,048	,085	,090	,110
Incubator manager	,434***			,168**
Initial development	-,288***	-,315***	-,166**	-,200**
Team	,008	-,085	-,053	-,037
Client interaction		,445***		,214***
Use			,568***	,375***
N	135	135	136	135
R2	26%	27%	37%	44%

*Sig at the 0.1 level

** Sig at the 0.05 level

*** Sig at the 0.01 level

The regressions reported have from moderate to good explanatory power, between 15-45 % explanatory power.

6. Discussion and conclusions

Drawing on co-production theorizing we have in this paper shifted the focus from whether or not incubators add value (i.e. the traditional approach), to *how* value added is created during incubation in dyadic and triadic relationships and interaction patterns between incubator managers and client firms. Previous literature has struggled to answer how and under which conditions incubators “produce” value added from incubation, arguably since research on incubation has had a rather a-theoretical nature (Aboen, 2009) driven by a focus on empirical data and control-group estimation econometric techniques (Ahmed, 2014).

In order to contribute to the development and testing of such theorizing, an analytical model highlighting how value added from incubation may be created in co-productive dyadic and triadic relationships between incubator managers and affiliated clients (incubatees) was developed. While the model is based on the literature (e.g. Rice, 2002; Ahmad, 2014; Ahmad & Single, 2011; Hacket & Dilts, 2004), it nevertheless connects different literature streams in a new way and offers a synthesis of it in the form of set of hypothesized relationships between key mechanisms and relationships involved in co-creation of incubator output, as recently called for in the literature (e.g. Ahmad, 2014; Aboen, 2009).

The model hypothesizes that the incubator manager and the client firm both have an important role to play in the creation of value added from incubation. Both actors need to be active participants in the incubation process and create value in dyadic and triadic relationships among themselves. While clients demand for knowledge and resources is a key driving force, showing that client readiness is a crucial mechanisms lying underneath the creation of outputs from incubators. However, this readiness needs to be matched by incubator managers by allocating attention to clients and offering services to them that they will use (e.g. Rice, 2002). Interaction with incubator managers and the use

of services from the incubator are subsequently founded to be two important mechanisms creating value added from incubation. In addition, the incubator manager has an important role to play as a broker, connecting client firms with each other, a crucial mechanisms lying underneath triadic relationships in the incubator creating valued added from incubation (i.e. Ahmad, 2014).

The empirical validation of the model is a small step in the direction of opening-up the black box of business incubation (Hackett and Dilts, 2004b) as the model and stated hypothesized relationships helps to explain how incubators have value added contributions, as called for in the literature (Aaboen, 2009; Barbero et al., 2012). Thus, the model argues that incubation effects are not mainly a question about *whether or not* incubators influence the development of new ventures. Rather, it is a question about under which circumstances they influence the positive development of such firms and through which mechanisms.

As the model and the empirical results suggests, the mechanisms which lead to higher value added contributions from business incubation is the existence of incubator firms characterized by higher client readiness and an incubator environment in which the incubator manager devotes gracious time for counselling and offers services that incubator firms use, in addition to interaction and learning among fellow incubatees. Thus, the model and the empirical results clearly suggest that value added contributions from incubation are produced in the relationship between the incubator and incubatees.

A shortcoming of the research in this paper is that we have only examined the relationship between the overall levels of incubation services, counselling, demand and value added contributions from incubation. However, some types of services, advice etc may be more critical than others; either because they are more strongly needed by incubated firms or because the firms are better able to

make use of them, and thereby associated with higher value added contributions. A better understanding of how different types of services produce value added contributions when interacting with different types of demand and client readiness is important to move research in this field forward. Future research should also look into how client readiness and demand depend on the initial resource base of the incubated firms, as well as on the nature of the relationships created with the incubator.

Another limitation is the cross sectional nature of the regression analysis. Longitudinal quantitative data on the incubation process spanning a higher number of firms across different incubators is needed to get better insight into how value added from incubation is created. A related shortcoming is that we have not analyzed differences across incubators. Incubator heterogeneity is important to examine in relation to how value from incubation is created for the focal firms participating in the incubation process.

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