

FIRM SIZE & INNOVATION: THE ADVANTAGES OF A SMALL VS. LARGE FIRM SIZE FOR INNOVATION

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Abstract

Public perception suggests that large firms are slow, sluggish, inefficient, and bureaucratic and stifle innovation. Small firms instead are perceived as informal, agile, open, efficient and full of innovation. If large firms would be so bad at innovating, then why do these still exist? A review of relevant literature regarding the relation between firm size and innovation is executed which concludes that this area of research is heavily divided. Instead of taking sides, the advantages of both large and small firms for innovation are discussed. By collecting qualitative data in interviews with business leaders of both small and large firms, these advantages are tested. The qualitative data suggests that the large resource base large firms have might be an advantage for innovation, although it depends on the industry the firm is active in as some industries do not require a large resource base for innovation at all. However, due to this resource base, large firms can in fact invest in innovation projects over longer periods of time than small firms even if they do not generate profits. Another advantage of large firms is diverse resources enabling them to execute a wider range of projects. Small firms instead have narrow resources and often bet on one or a few projects to succeed and fail if these do not. However, small firms also have their advantages for innovation. Small firms have lower bureaucracy, show agile response to changing market conditions, have ownership and management that is often consolidated and are therefore able to focus more on long-term innovation goals than short-term profit maximization goals. It is concluded that large and small firms differ and that they both have advantages and disadvantages which are applicable in different situations. In addition, the results from the interviews in this paper suggest that large firms should be able to mimic the advantages small firms experience in innovation while removing the disadvantages associated with their size by changing their organizational structure and leadership. Further research should not investigate the general relation between firm size and innovation but instead focus on how this relation differs by industry. This information is useful for business leaders who can consider how their innovation performance might change when they expand or scale down their organization.

Keywords: Firm size; Innovation, Bureaucracy; Organizational structure; Conglomerates; Entrepreneurship

1. Introduction

In their article “When Growth Stalls” (2002) and subsequent book *Stall Points* (2008), Matthew S. Olson and Derek van Bever show how the majority of Fortune 100 firms at one point in their existence experience a moment in which their growth rapidly decreases for some years and how after this moment they are seldom able to recover and capture the same growth as they did before. One of

the most important reasons for this *stall point* were “innovation breakdowns”, the firms innovation performance had decreased to a low resulting in the firm becoming unable to compete with other players in the market and remain competitive. Remarkable is that all firms reached considerable size at the time they reached their stall points; many were the largest they had ever been in terms of number of employees and financial outputs. In an article regarding Olson and Bever’s book, Professor Jim Heskett (2009) of Harvard Business School suggests that the decrease in innovation might be caused by the increase in firm size. Heskett is not the first to suggest this relation; in fact his arguments are part of a larger debate that has been going on for decades in and outside of economic and business literature. The debate is if a firm’s size influences innovativeness.

1.1. Background

Remarkably, as so many people nowadays work in large organizations, the larger public outside of literature also seems to take part in the debate on the relation between innovation and firm size. How often do people not talk about large organizations as being formal, sluggish, closed, inefficient and outright bureaucratic? It appears impossible to push any changes through and large firms have become slow giants. The perception is that large firms are driven by profit maximization and not product development; they like making money, not better products. Smaller firms on the other hand seem to be on the upper hand: they are perceived as innovative, informal, agile, open, and efficient; having short communication lines promotes their speed and innovation. They rapidly respond to market demand and are more connected to what is happening in society. Small firms are perceived as open entities which like to share resources and cooperate with other businesses. Reasoning is that for these reasons, it would be easier for a small firm to complete the cycle of innovation: They are better at (1) understanding customer demand (through their openness); (2) rapidly invent a product (through their focus on product development); (3) rapidly develop the product (through their agility); and (4) successfully launch the product in to the marketplace (through their short communication lines). Thus it would be more likely to attach high innovative performance to small firms than large firms. However, the previous is all perception of public opinion. Now if innovation is essential to maintain competitive in the marketplace, and if popular opinion suggests smaller organizations to be more innovative, then why do large organizations still exist? If they are so sluggish, why would they not choose to split up in smaller independent firms or units? There must be reasons for this. Logic suggests that small and large firms differ considerably (Eitlie & Rubenstein, 1987). This difference is the focus of this paper.

1.2. Previous Research

Introduction

The discussion on the influence of firm size on innovation was essentially started by Schumpeter in his pioneering work “Capitalism, Socialism and Democracy” (1942). Schumpeter stated that large firms will be ‘more than proportionally more innovative’ than small firms. He quickly gained a following and the *classicist* camp was formed. The *classicist* camp states that there is a positive relation between firm size and innovation; the larger the firm grows the better it becomes at innovating. Its arguments include that larger firms have the advantage of economies of scale in innovation and can thus try many ideas and have a few succeed and that they have more market power

and can therefore actually bring innovations to the marketplace easier. On the other end of the debate there are the *modernists* who state that there is a negative relation, thus the smaller the firm the better it becomes at innovating. Its arguments include that smaller firms are more flexible, agile and can adapt easier to the environment and are thus able to better innovate. Finally, there is *nihilist* camp that states there is no relation at all and that it is simply an invalid question. Much empirical research has been executed investigating the relation between firm size and innovation. The results obtained by these three camps will shortly be discussed to give a background on the topic.

Classicists argue a positive relation

According to Nord & Tucker (1987) large organizations have greater technical knowledge. In addition they have more diverse and complex resources and skills (Damanpour & Evan, 1984) and are more able to take the financial losses when an innovation is not successful in the marketplace (Hitt, et al., 1990). Therefore, they are able to adopt a higher number of innovations than smaller firms. Camisón-Zornoza, et al. (2004) confirm this relation with a meta-analysis on a collection of literature regarding firm size and innovation. Their results indicate that the relation between firm size and innovation is positive although low. Eitlie & Rubenstein's (1987) results indicate that there is a significant relation between innovative output and firm size in firms between 1,200 and 11,000 employees. Wakasugi (1997) investigated the relation in the Japanese electrical industry. Wakasugi found that large firms were more aggressive in pursuing their innovation efforts than small firms. In addition, they found that research and development (R&D) expenditure grew proportionally more than firm size, indicating larger firms spend more on R&D relative to their size than small firms do.

Modernists argue a negative relation

Acs & Audretsch (1987) used the number of innovations per industry, the *innovation rate*, to measure innovation. Their results indicate that mean innovation rate was 43% higher in small firms than large firms in the U.S. Eitlie & Rubenstein's (1987) results indicate that very large organizations (with over 45,000 employees) are highly unlikely to introduce radically new products and develop innovative output. According to data from Gellman Research Associates, Inc. (1982) small firms produce 2.5 times as many innovations as large firms, relative to the number of people employed. Hansen (1992) results suggest that both firm age and firm size tend to be inversely related to the innovative output of a firm. The larger or older a firm thus becomes, the less it tends to produce innovations. Stock & Greis (2002) investigated the relation in the computer modem industry. They found a negative relationship between firm size and dynamic innovation (innovation which consist of a series of technological innovations). Small firms tended to have a higher rate of change in product performance than large firms. Their findings suggest that in dynamically innovative environment such as the technology industry, small firms may be more innovative due to the high level of change in the environment that forces them to be.

Nihilists argue no relation

Eitlie & Rubenstein's (1987) results indicate that there is no relation between innovative output and firm size in firms below 1,000 employees. Pla-Barber, et al.'s (2007) results confirm this finding firm size not be a determinant for innovation whatsoever.

Conclusion

It is healthy for a research area to have division and debate, but the debate in the area of firm size vs. innovation is extraordinarily fierce. All camps are able to found their findings successfully with theories, data and results and up until now it has been impossible to find a consensus, except for the consensus that there is no consistent answer to what the relation between the two constructs may be (Camisón-Zornoza, et al., 2004). The reason for contradictory results and lack of consensus may be that both innovation performance and firm size are heterogeneous and multidimensional concepts that are difficult to define or measure; they are in fact measured by indirect manifest variables such as number of patents for innovation or employee count for firm size (see previous sections). In addition, results depend heavily on which industries are investigated and which business activities the firms have. Acs & Audretsch (1987) confirm this point; they suggest a negative relation but they do state that the innovation rate depends heavily upon which industry is looked upon and differs by industry. Camisón-Zornoza, et al.'s (2004) meta-analysis finds a positive relation but they do not account for firm size and innovation in different industries either; instead they simply average the scores of all the previous literature. Which industry is researched seems to be a moderating factor in the relation between firm size and innovation.

1.3. This Research

Objective

Literature on the relation between firm size and innovation performance is divided and it would be useless to try and take a standpoint in the debate without executing any empirical research in this paper. The issue is clearly not black and white and therefore, instead of answering it in this fashion, this paper strives to answer it by showing what the differences and in specific the advantages of both large and small firms are based on empirical findings in literature. This paper will investigate this area of research to find these advantages in literature, convert these into factors, derive hypotheses from these factors and finally test these in reality through interviews with business leaders of both large and small firms.

Scope

The scope of this review is worldwide business, economics, organization and sociology literature concerning small and medium business enterprises (SMEs), organizational units, large organizations, corporations and conglomerates.

Relevance

Business leaders are regularly required to make decisions on expanding their firm or in case of decreasing performance scaling it down instead. Literature is not able to produce a consensus on the relation that holds for *all* situations, but it does give empirical results that show in which *specific* situations innovation may be more associated with a large or small firm size. This is valuable information to have as a leader and can influence the decision making process of small and large organizations in building their strategy for the future. In addition, policy makers in governments

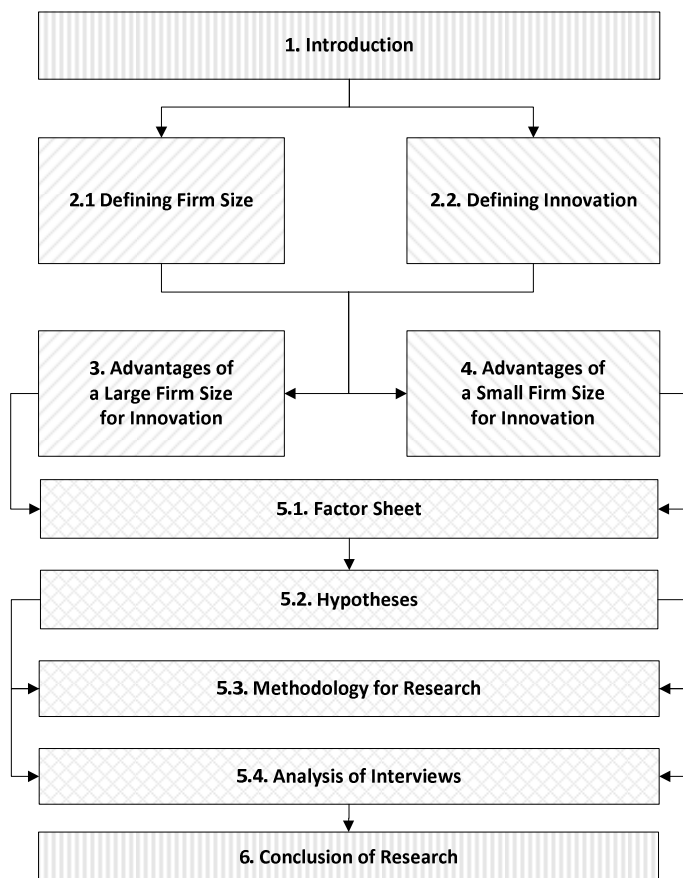
worldwide can use this research to their advantage by encouraging firms in certain industries to either remain small or split up in smaller units, or instead grow large and consolidate many firms into one, if it is shown to be advantageous for their innovative performance. This behavior can be stimulated through tax cuts or subsidies for firms of certain sizes in specific industries. As most firms will have a management that always wants a firm to grow larger and larger, they might need an external party like the government to influence them not to if it is not beneficial to their innovation performance.

Method of research

For this research a qualitative analysis of relevant previous literature is executed and qualitative data collection by means of interviews with business leaders. The research questions are answered with results and statements from relevant literature articles which are then tested with real-world qualitative data.

Research question

- (1) What are the differences between large and small firms in terms of innovation?
 - (A) How can firm size and innovation be defined?
 - (B) What are the advantages of a large firm size for innovation?
 - (C) What are the advantages of a small firm size for innovation?



Structure

To be able to discuss the relation between firm size and innovation, it is required to know what these terms mean and how they are defined in literature. Therefore, defining firm size in chapter 2.1 and innovation in chapter 2.2. Then we will discuss the advantages of both large and small firms for innovation in chapters 3 and 4. In chapter 5.1, we convert these findings into factors that increase or decrease innovation performance. From these factors we derive hypotheses in chapter 5.2., which we test by means of interviews. The methodology for this is explained in 5.3. In chapter 5.4, we analyze the interviews and collect test results. In chapter 6, our findings are discussed and used to answer our research question and sub questions. We also discuss the limitations and managerial and academic implications of this research with recommendations for further research regarding the relation between firm size and innovation.

2. Definitions

Introduction

In this paper relation between firm size and innovation will be studied. Studying these constructs requires to define them first. Firm size and innovation are both difficult constructs to define because they are so multidimensional and can only be indirectly measured. Literature has measured these in different manners and these will be discussed to come to a better understanding of the constructs.

2.1. Defining Firm Size

Firm size is a multidimensional and latent construct. The results of research using firm size as a variable clearly depend on how firm size is defined.

The lack of consensus in literature regarding how firm size should be conceptualized gave rise to Kimberly (1976) calling the research area so much as a ‘theoretical wasteland’. Many different measures can be employed. Roughly, there are four manifest measures of firm size which are used when defining firm size. These are (1) the financial resources that the organization has access too, including such factors as working capital; (2) the physical capacity of the organization (the ability to meet profitable customer demand); (3) the number of employees working in the organization and (4) the volumes of (immaterial or material) input and output (Camisón-Zornoza, et al, 2004). Some theorists suggest it would be more useful to apply different measures to different industries: e.g. using physical volume of output for chemical manufacturing firms, the financial output for banking firms and the amount of employees for non-profit firms (Damanpour, 1987).

Furthermore, the question arises which is the level at which a firm below is small and above is large. Theorists and governments have set this limit arbitrary based on their manifest measure of choice. In Europe, the definitions of the European Union are mostly used which defines a small firm as a business which has fewer than 50 employees and an annual revenue and/or annual balance sheet total which does not exceed EUR 10 million. A large firm is defined by the EU as a business which has over 250 employees staffed and an annual revenue of over EUR 50 million (European Union, 2003). In the United States (US) the definitions of the U.S. Small Business Administration (SBA) are used which defines the size of a firm based on the industry it is active in. Overall, the SBA defines a small as having fewer than 500 employees and an annual revenue of less than USD \$10 million (U.S. Small Business Administration, 2008). As the majority of the research on firm size and innovation used in this paper was executed in the United States, the SBA’s definitions will be used in this paper.

2.2. Defining Innovation

The problem of multidimensionality and heterogeneity does not limit itself to firm size as a latent construct. Innovation has the same issue and this is also one of the causes for the disparate results in literature. The complexity of measuring a heterogeneous concept like innovation is challenging. Schumpeter (1942) was one of the first to strive to define the concept of innovation. His most common definition of innovation is the introduction of a new good, a new quality of a good or a new method of production. Zaltman, et al. (1973) defines it as the process of creation, development and implementation of new ideas. The U.S. Small Business Administration has a more extensive definition, defining innovation as “a process that begins with an invention, proceeds with the

development of the invention, and results in the introduction of a new product, process or service to the marketplace” (Edwards and Gordon, 1984). This definition can be expanded into the innovative performance of an organization: “the ability of an organization to successfully produce an invention, develop this invention to a product, process or service and introduce this product, process or service to the marketplace”.

Defining innovation and innovative performance is one step, measuring it is more challenging and often moves researchers into using indirect measuring tools. Previous literature has used the organizational input reserved for innovation (e.g. the budgeted resources allocated to R&D) or the amount of patents registered by an organization. The fallacy of both measurements is obvious; merely budgeting resources for R&D does not necessarily result in innovations that are of value. Merely using the amount of patents registered also does not give any insight to the financial or social value; the majority of patents registered in the U.S. never gets used and are often mere instruments to block competitors moving into areas of production of a firm.

Fortunately, there are in fact direct measurements of innovation available. The U.S. Small Business Administration regularly records new innovations from over a hundred trade journals within every business industry. Based on this data it calculates the number of innovations per employee in each industry, the so-called *innovation rate*. To account for differences in industry size, the number of employees is used in calculating the innovation rate. This gives a direct measure of innovation to use.

Conclusion

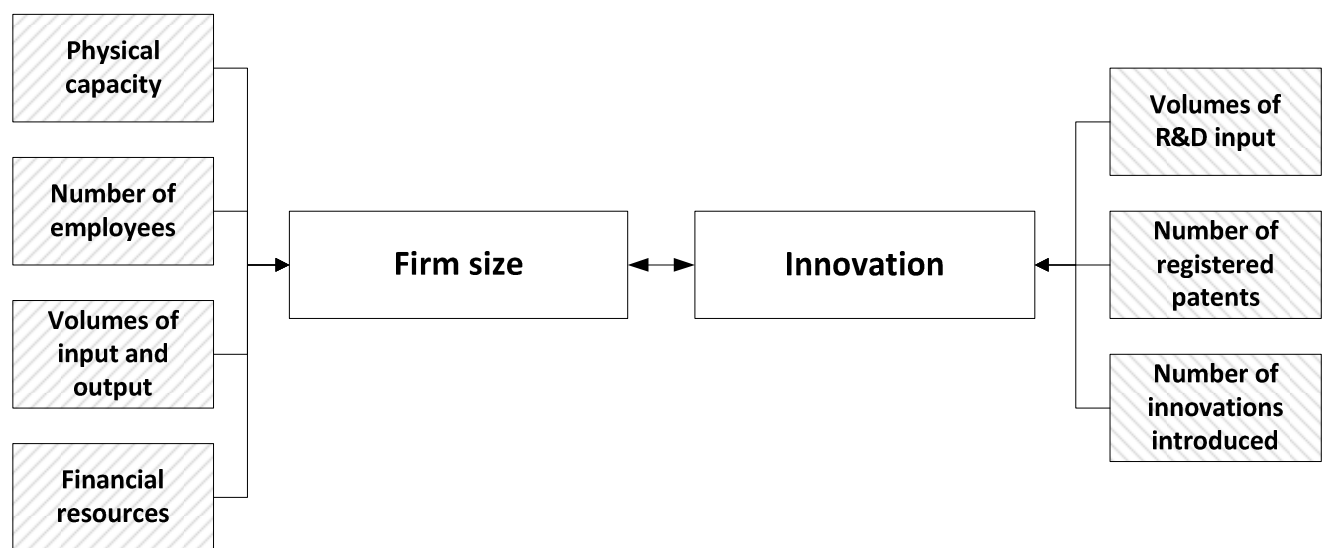


Figure 1: A model of the relation between firm size and innovation based on previous literature

Based on the previous definitions of organizational size and innovation, a model of their relation and definitions is created, which is shown in figure 2. In this model, firm size is a latent construct (striped boxes) with four manifest variables (clear boxes) that constitute a subjective measuring scale. Innovation is also a latent construct with three manifest variables. Firm size can be measured by manifest variables of the physical capacity of the firm, the number of employees a firm staffs, the volumes of (material and immaterial) input and output and the financial resources the firm has. Innovation can be measured by manifest variables of the volumes of research & development input,

the number of patents a firm registers and the number of innovations a firm introduces. All these manifest variables are limited in their applicability though and are used in different research situations.

3. Advantages of a Large Firm Size for Innovation

Introduction

From previous research, it is known that the relation between firm size and innovation is not black and white. Large and small firms both appear to have advantages for innovation in different environments. Relevant literature on the topic will now be reviewed and discussed which shows that large firms are in some ways better suited to innovation due to specific differences they have with small firms. These advantages are discussed in-depth to further understanding on the topic in terms of large firms.

Economies of scale

One of the most important reasons for consolidating multiple organizations into one, and thus growing them from small to large, are economies of scale. It is the cost advantage that a firm can obtain by expanding. Resources can be acquired for a lower cost and firms have more bargaining power towards their suppliers. In terms of production, lower unit costs become possible due to a higher volume of production. These economies of scale do not limit themselves to merely overall business operations, instead they appear to be of significant value in innovation and research and development (R&D) processes too. Because larger firms have a greater scale, they often run more innovation and R&D projects and launch more new products than small firms (in absolute numbers, that is). Therefore, they are able to spread the cost of innovation and R&D over more products and/or projects. Thus, there are economies of scale to be found in the individual cost of an innovation (Cohen & Klepper, 1996; Crane, 1997). This means that large firms can produce innovations at a lower cost. This is not the whole story though, as there is also evidence that actually shows that economies of scale are present in all areas *except* innovation and R&D, which is described later in this paper in the small firm section.

Large resource base

When large capital investments are required for innovation activities, it is not the small and medium-sized firms that are innovative anymore, as their limited financial resources make it impossible for them to compete (Eitlie & Rubenstein, 1987). Empirical findings by Acs & Audretsch (1987) confirm the previous points; they state that small firms are generally at a disadvantage in industries which are capital-intensive because they lack the resource base that large firms have and need in these industries. Additionally, large firms can diversify their innovation investment into a high number of projects, of which they select a few to introduce into the marketplace and of which only a few need to succeed to make them profitable (Hitt, et al., 1990). Their resource base also acts as an advantage as it can act as a buffer if an innovation fails. Small firms experience the complete opposite effects: they often have only one innovation or new product to launch and their success is directly related to the product's success in the marketplace. They are 'betting on one horse' as they say. Small

firms are often unable to continue operations when their core product or innovation fails in the marketplace (Eitlie & Rubenstein, 1987). This may explain why smaller firms fail more often than large firms (Teece, et al., 1997); they simply have fewer buffers to take the blow of failure¹. In addition, innovations that require long-term heavy investment which become profitable only after a long time (such as most bio-technology products) are not as easy to execute by small firms because they are not able to acquire the long-term resources necessary which large firms can (Eitlie & Rubenstein, 1987). For these reasons, large firms can launch a higher number of innovations and can execute more long-term innovation projects than small firms.

Diverse resources

The resource base of small and large firms differs substantially and herein large firms have a very important advantage for innovation. In general, large firms have a much more diverse and complex resource base (Damanpour & Evan, 1984). The diversity in their resource base originates from the fact that they run much more innovation projects (in absolute numbers) than small firms. Therefore they are able to acquire much technological know-how and resources (Nord & Tucker, 1987) for one project and apply these for a long time after in many other innovation projects and products (Stock & Greis, 2002; Damanpour, 1992). For example, DuPont's invention of the strong Kevlar material was meant for racing tires but is now used in everything from body armors to ship sails. Small firms experience the opposite effect as they run just a few innovation projects which give them a very narrow resource base. In fact, due to their lack of diverse resources, small firms are often forced to cooperate with other firms that do have the resources they need for an innovation project (Hitt, et al., 2001).

Formalized innovation

Large firms understand that innovation is essential to remain competitive. For this reason, many strive to integrate innovation into the continuous operations of their organization. The most common way of doing this is by creating a research and development (R&D) department. By using R&D departments, firms organize to continue the flow of new ideas by formalizing innovation into a functional task (Eitlie & Rubenstein, 1987). One advantage is that innovations can be routinely screened for their ability to actually be innovative, radical or function in the marketplace. Thus, by instigating an R&D department, firms can separate the cream of the crop from their innovations. This may increase the probability of successful introduction of innovations. In addition, as innovation becomes a functional task for large firms (rather than the natural activity it may be in small firms), they are able to pursue the activity more aggressively than smaller firms (Wakasugi, et al., 1997). Small firms are unable to formalize innovation as they simply do not have as many innovation projects due to their limited resource availability.

¹ It should also be noted that the popular perception of small firms being more innovative may be exactly for this reason. Because small firms fail so often, press coverage focusing on innovative small firms may occur only when they have reached success, while the failing firms are ignored and discounted. Instead, when a large firm fails all eyes are upon them and they often receive intense public scrutiny because they were successful before.

Conclusion

Research shows there are indeed advantages to a large firm size for innovation. Large firms can take advantage of their strong economies of scale resulting in lower overall costs for innovation. They have a larger and more diverse resource base by which they can make a greater amount and larger size innovation investments which require a return on investment that can lay far in the future, as their resource buffer is so great compared to small firms.

4. Advantages of a Small Firm Size for Innovation

Introduction

Relevant literature on the relation between firm size and innovation will now be reviewed and discussed which shows that small firms are in other ways better suited to innovation due to specific differences they have with large firms. These advantages are discussed in-depth to further understanding on the topic in terms of small firms.

Low bureaucracy & agile response

As mentioned in the introduction of this paper, popular perception of large firms suggests that they are amongst other things, sluggish and bureaucratic. Small firms on the other hand appear agile. This is almost completely confirmed in literature. Cohen & Klepper (1996) confirm that large firms' bureaucratic properties cause them to be slower to respond to changes in their environment, such as the introduction of new competing products or services, and the opportunities arising out of those changes (Cohen & Klepper, 1996). There are many reasons to be found for this slow response: (1) Communication is essential in the creation, coordination and marketing of new innovations and takes more effort in large firms as they have longer communication lines between employees; (2) Large firms are more bureaucratically structured with formal vertical structures as opposed to the informal horizontal structures often used in smaller firms. This bureaucracy leads to even more difficulty in communication and coordination of innovation (Stock & Greis, 2002) which at its extreme can cause *bureaucratic inertia*, the inability to function properly due to bureaucracy; (3) Large firms create a stronger resistance to change as they become more institutionalized and often resistant change out of sheer complexity, meaning that the firm has often become too complex to try and implement changes (Eitlie & Rubenstein, 1987); (4) Many large firms have become large not only by natural growth but often by acquisitions, mergers and consolidations. All three of these are fraught with difficulties and most do not create the increase in efficiency or scale that was planned (Loomis, 1999; Garten, 1998). Many firms would be better off, if they would have remained separate and smaller. All these effects are directly related to a firm's scale as no literature speaks of these effects with small firms. Instead, small firms appear to be less vulnerable to bureaucratic inertia (Gilder, 1988) and have fewer employees by which the lines of communication are a lot shorter. All of this makes the communication and coordination of innovation and launch of new products easier than in large firms (Sosa, et al., 2002) and it makes them a lot better at rapidly responding to changes in the environment, such as the introduction of competing products in the marketplace. They are also a lot more flexible in dealing with unexpected changes (Rogers, 2004) and are in general more agile than large firms (Stock

& Greis, 2002). The effect is especially strong in industries which are highly innovative and experience continuous rapid change. In those industries, small firms have a high advantage over large firms in their innovative operations (Acs & Audretsch, 1987). Concluding, small firms appear to have a significant advantage over large firms merely because they are *not* large.

Radical innovation

As previously mentioned, small firms are more inclined to produce radical innovations than large firms. Small firms tend to introduce more products that are radical departures from the past than large firms (Eitlie & Rubenstein, 1987). There are many reasons for this: (1) It may be a natural occurrence as when industries are young, firms require a lot of new radical (technological) innovations², while when industries grow older, firms require only modifications to the existing innovations or process of production of these innovations (Dosi, 1982); (2) Large firms generally have more market power than small firms which influences their risk preference. In general large firms are more risk-averse in their behavior than small firms (Hicks, 1935), making less revolutionary decisions and creating less radical innovations. When small firms fail, there is less lost than when large firms fail. Therefore small firms are more suited to taking risk; (3) Instead of taking the risks themselves, there is evidence that large firms rather capitalize on innovations developed by small firms, by acquiring these when they prove successful (Peterson & Berger, 1975), and thus risk is shifted to smaller firms. It has become a natural function for small firms to take the risks of radical innovations; (4) Small firms are more flexible and agile (Stock & Greis, 2002) and are thus more able to introduce radically new products that connect more to market demands. On the opposite, large firms suffer from bureaucratic inertia which makes it easier to implement improvements to existing products or processes and more difficult to introduce radically new products; (5) Small firms cannot make product improvements to have their 'share' of innovation, as most of the time they have few or no previous products to improve upon. Therefore, they often have no other choice than to come up with radical product innovation (Cohen & Klepper, 1996). Large firms on the other hand have an existing output infrastructure and resource base. Therefore they rather select innovation projects that can be developed and put in to the market place through this resource base and infrastructure, than projects that do not. This naturally makes the innovations selected less radical as they need to fit in with the firms' innovation activities that are already running.

Ownership-management consolidated

Adam Smith (1776) argued in the "Wealth of Nations" that when in a firm ownership is separated from management, management will inevitable begin to neglect the interests of the owners at some

² The question that remains is if incremental improvement is actually inferior to radical innovation. Both developments are probably just as necessary and part of the product/organizational life cycle. Radical innovation is important early on in the launch of a product/firm and incremental innovations are important later on when the product/firm has matured. It would thus be unfair to make value judgments about one of the two is better. The literature is divided on this and that is why much of theory does not even speak of "process improvement" but instead of "process innovation". However in our definition of innovation we do refer to innovation as "a process that begins with an invention, proceeds with the development of the invention, and results in the introduction of a new product, process or service to the marketplace". Incremental process improvement does not introduce a new product or service; it instead merely improves upon these. Therefore with our definition of innovation, this focus on radical product innovation instead of on incremental process improvement is described as an advantage to small firms.

point, creating dysfunction within the firm. This argument is still valid today. The nature of small firms is that ownership and management are usually one entity; most entrepreneurs that start a firm control it, at least in the first stages of the growth of the firm when it is relatively small. In large firms ownership and management is usually separated. Large firms may be owned by public or private stockholders who have appointed managers to operate on behalf of them and in their advantage. However, this construction is often problematic as managers' performance can only be evaluated by short-term financial measurements such as revenue and profit goals which do not take into account long-term growth in immaterial assets such as innovation. The nature of this construction ensures managers' main focus will be on short-term profit maximization (Crane, 1997) and less on the long-term growth in immaterial assets such as innovation. The fact that managers operate with other people's resources, may also make them more risk-averse (Hicks, 1935) which is bad for innovation. More so than the owners of small firms, managers in large firms will try to avoid risky decisions, but these decisions do not necessarily benefit innovation, which in its nature is a risky endeavor. In this respect, small firms are at a great advantage as it enables their owners to make long-term strategic decisions regarding innovation and make the resources available for these projects without having to justify their decisions with their shareholders.

Innovation as a goal

Marx (1844) introduced the concept of *worker alienation* in 1844, yet it appears to be as valid as it was more than a century ago. Worker alienation describes how a worker may become alienated with the product he produces because its design and production are appropriated by the owners of the firm. The workers feels increasingly less connected with the product he produces as he has less influence on it. He merely executes the orders of management in the production of the product. This effect becomes apparent when firms grow large. Employees in large firms have less contact with the actual product or service they are offering than in small firms. They receive tasks and orders and act in functional departments where they often only produce part of the product. A package designer may create packaging designs for thousands of products, most of which he will never actually touch or have anything to do with. Therefore, they may become less motivated to do their creative work than in a small firm. In a small firm, there is a few products offered and engineers and other creatives often have multiple roles in which they are closely responsible for the entire product development and marketing. In addition, the financial compensation of an employee in a small firm may be more tightly linked to performance than in a large firm; engineers often receive a compensation package in small firms of stock or options, due to the lack of cash capital. Finally, the contribution of one employee to a product in a small firm may have a more visible influence on the firm's performance than in a larger firm, which again leads to higher motivation (Kamien & Schwartz, 1982). This advantage is also applicable to the previously mentioned problem of the separation of ownership and management in large firms (Smith, 1776). As smaller firms are often managed by their owners, they are indeed more connected to their production and product and have more incentive to create long-term growth using innovation as a means, than to maximize profits for the short-term (Crane, 1992).

It is not merely the concept of worker alienation that decreases innovation in large firms. The market environment large firms operate in also plays a large part: they are often part of oligopolies; these are markets which are dominated by a few large firms or conglomerates and which have high barriers of entry (Stigler, 1964). In oligopolies, large firms control a large proportion of the market

and each firm strives to procure the largest share of the market. These markets have a disadvantage for innovation though. In general there is less incentive to innovate and more incentive to maximize profits and increase market share; the emphasis has shifted from innovation to profit making (Bagdikian, 1990). This can be explained due to the nature of oligopolies. Oligopolies rationalize innovation to manage the pace in which it moves. The few firms in an oligopoly don't collude but create methods of containing innovation and signaling pricing to each other. In these tightening oligopolies it is not the creative innovators that make the decisions, but instead the cost cutters, brand extenders, mergers and acquisition experts become of importance (Rubin, 2002). For these reasons, being in an oligopoly is detrimental for innovation. Small firms have an advantage by not being able to operate into these markets at all due to the high entry barriers and their small scale. Instead, they operate in the opposite environment: markets with close to perfect competition. In this environment innovation is actually necessary to remain existent as a firm. An example of these two environments was observed by Crane (1997) in the United States movie market which in the mid 20th century consisted of many independent production firms which at the end of the 20th century were consolidated into a handful of media conglomerates. These conglomerates increasingly became more focused on producing blockbuster movies with standardized characteristics rather than producing productions with radically new creative ideas.

Innovations in small firms also have shown to be more socially valuable than in large firms. Large firms often operate in markets with a few other large players (such as oligopolies). What happens is that the output of the market is consolidated (or merged) into a few firms' output. However, having so few players in a market can decrease competitiveness and create a stronger focus on financial goals instead of innovation or social goals. This is confirmed in research as having many competitors operate in a market has shown to improve innovations that are of social value rather than financial value (Cohen & Klepper, 1996).

Openness and high cooperation

Small firms have more incentive to cooperate with other firms, as they do not have the necessary resources for an alternative strategy (Hitt, et al., 2001). In this respect, they become more open to input from and cooperation with other organizations which in turn can breed more innovation and create a less isolated organization which brings in more ideas from outside, which is great for innovation. Small firms also experience an advantage in how their workforce differs from large firms. Where small firms often have a highly varied mix of people that join a company and relatively quickly leave again, a large firms' employee base consists of many so-called *lifers*. These are employees that have been active in the firm for long periods of time and have slowly moved up in to the organizational hierarchy. Research shows that recruiting new (executive) talent is essential to keep an organization up-to-date and can offer fresh perspectives, knowledge and approaches to problems for an organization in both management and innovation (Olson, et al., 2008). Having *lifers* take up most roles in a firm creates a more isolated introvert and closed off organization. For these reasons, executive teams in larger organizations tend to be more isolated than those in small ones. A lack of fresh ideas and innovation in executive management of large organizations has been mentioned as one of the reasons why 84% of Fortune 500 organizations have run into stall in their growth at one point in their history. This shows that small firms are at a considerable advantage due to their openness and high cooperation with other firms, institutions and people.

Diseconomies of scale in R&D

The previously and often mentioned economies of scale advantage for R&D in large firms have not always held up in empirical research. Analyzing a database of Swiss manufacturing firms, Arvanitis (1997) found no evidence at all of economies of scale in their innovation activities. In fact, some research find the opposite effect; Wakasugi's (1997) empirical findings suggest that there are diseconomies of scale present in product development, even if there are economies of scale to be found in all other areas of an organization. This suggests that innovation does not let itself scale up; it is a hard to control the process due to its creative nature. Merely raising its inputs does not mean its outputs will grow more proportionally, the opposite is found. Another striking point is that with large-scale research and development in large organizations, many research findings (innovations) actually go unnoticed and unrecognized and are never implemented or marketed (Stock & Greis, 2002) due to their being so many. With so many innovations, there is loss of focus and it becomes necessary to select with the risk of indeed neglecting a very important innovation. This has often happened in the past and many of these neglected innovations are in fact either licensed or simply copied by (smaller) firms who do recognize their value. A popular example is the development of the graphical user interface for computers by Xerox's PARC research institute, which was hardly recognized and instead copied by Apple and Microsoft to form the first personal computer graphical operating systems (Tuck, 2001). It may therefore be suiting to suggest that small firms may be able to take advantage of the diseconomies of scale present in certain innovation and product development departments and may be able to recognize valuable innovations better than large firms are, due to a more concentrated innovative effort in small firms.

Conclusion

Research shows there are also many advantages of a small firm size for innovation. More advantages were found for small firms than large firms; however this does not necessarily mean that the total effect is more advantageous for small firms as certain advantages were more important than others. The strongest advantage for small firms is the effects their scale adds to the equation. Because they are so small, they hardly have bureaucratic problems and because of this can quickly respond to their changing environment: they are more *agile* than their larger counterparts. In addition, they take more risk as they have less to lose and are therefore able to launch more radical innovations than large firms are. The fact that their ownership and management is often the same (few) people, means they can avoid focusing too much on profit maximization and instead make long-term innovation goals for which they can reserve the necessary resources. Due to the smaller scale of operations, employees in small firms are more in touch with production as they can often see their own contribution back in the final product. They are less concerned with making money as they are with making a great product. What kills innovation in large firms is often that they operate in markets with a few players (oligopolies). In these markets strive to rationalize innovation and reward the people that cut costs, extend brands, manage mergers and acquisitions instead of the people that actually create the innovations. Therefore, small firms have a distinct advantage by actually *not* being able to operate in oligopolies. Finally, small firms appear to be more open and cooperate more which promotes the flow of ideas in and out of the organization and thus creates a better environment for innovation.

5. Analysis of Interviews

Introduction

In the analysis section we will test our previously discussed theoretical findings. We will begin by identifying the factors that influence innovation with regards to firm size. These 10 factors are based on the advantages and disadvantages of small and large firms for innovation that were discussed in the previous review of literature. Based on these factors, we then go on to create 10 hypotheses. These hypotheses are statements regarding innovation and firm size and how they relate.

To collect data to test these hypotheses we have interviewed business leaders in small and large firms. The methods of this data collection by means of interviewing is discussed the methodology section. Finally, in the actual analysis we test each hypothesis individually based on the answers from the collected interviews and thereby accepting or rejecting these.

5.1. Factor Sheet

Based on the literature review of the advantages of both small and large firms for innovation, we can state 12 factors that large or small firms have which are either advantageous or disadvantageous for the performance of innovation in their organizations. Factors are used because the advantages for innovation for e.g. a large firm reflect the disadvantages for innovation for e.g. a small firm. The factors are coded with a number followed by 'a' for large firms and 'b' for small firms, being either advantages/disadvantages of a small or large firm size for innovation. The factors are illustrated in the chart in figure 2.

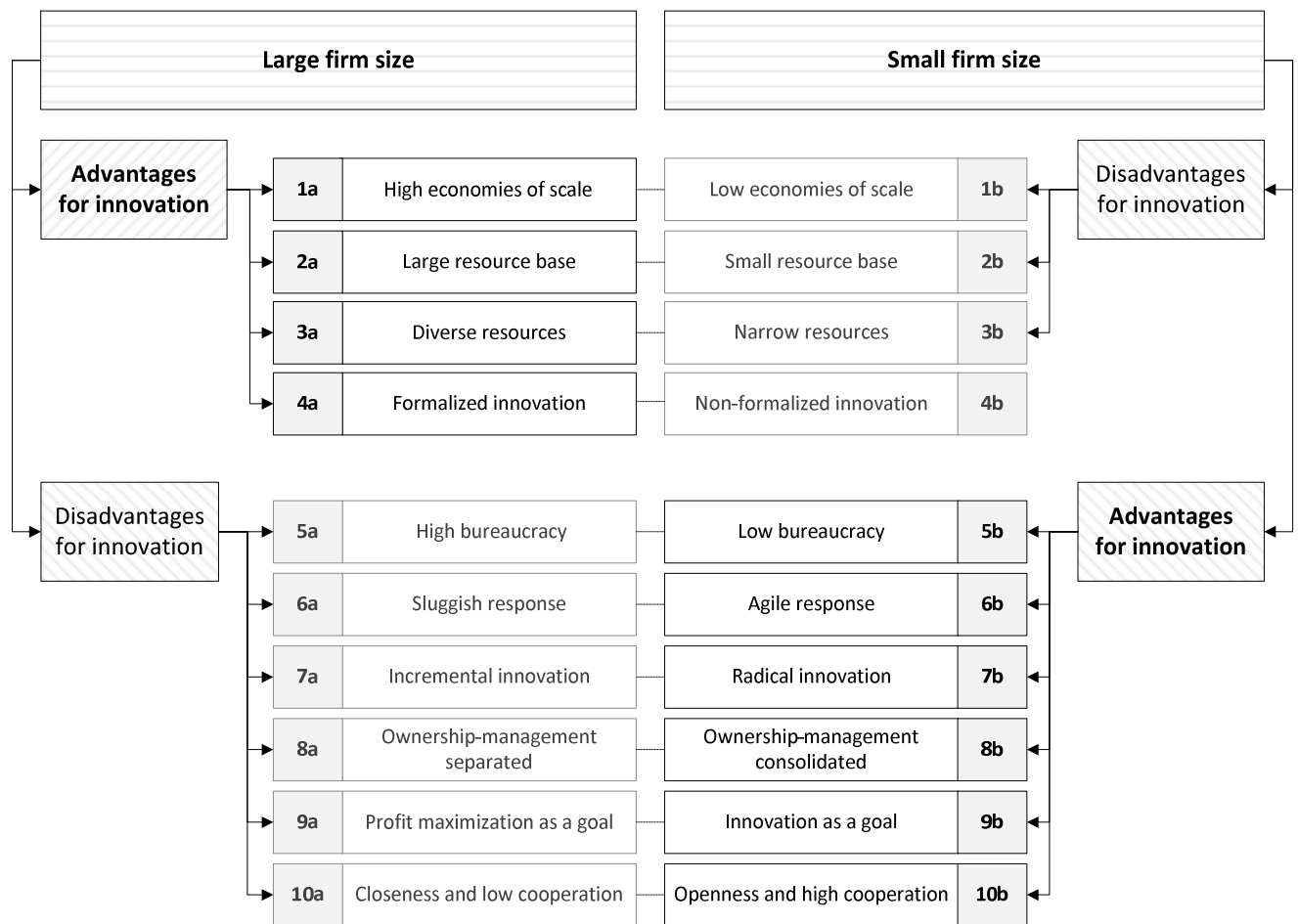


Figure 2: Factors of small and large firms influencing innovation

5.2. Hypotheses

Based on the factors from the literature review we are able to answer our research questions with the hypotheses below. The factor codes are shown in parentheses in the hypotheses and correspond to the factor sheet illustrated on this page.

(2) What are the advantages of large firms for innovation?

H1. “Large firms are able to develop products and innovations for a lower cost than small firms because they are able to spread out their research & development costs over more innovation projects (1a). Small firms are not able to do the same (1b).”

H2. “Small firms experience lack of (financial or other) resources (2b) which large firms do have (2a), disabling them to pursue certain innovation projects”

H3. “Large firms have more diverse resources (3a) than small firms. This makes it possible for them to execute a wider range of innovation projects than small firms which often have narrow and focused resources (3b).”

H4. “Large firms are able to make innovation a formalized task by fitting them into research & development departments (4a). Small firms are not able to do this because they do not have as many innovation projects (4b).”

(3) What are the advantages of small firms for innovation?

H5/H6. “Large firms are slower to respond to their environment (6a) and are more resistant to change due to high bureaucracy (5a) and formalized organization structures. Instead, small firms are rapid to respond to their environment (6b) and show agility due to short communication lines and low bureaucracy (5b).”

H7. “Large firms implement more incremental innovations (7a) than radical innovations. Talking about actual radical new products being introduced, small firms are in general more inclined to do this (7b)”

H8/H9. “In small firms ownership and management are often the same (8b). Therefore, management can actually make long-term decisions which would be advantageous for innovation. In large organizations ownership and management are separated (8a), causing them to focus on short-term objectives like maximizing profits (9a) instead of focusing on innovation (9b). In addition, small firms appear to be more in touch with their product than large firms for these reasons.”

H10. “Small firms are more open to the outside world and more inclined to cooperate with other firms (10b) than large firms that are more closed and hardly cooperate (10a).”

5.3. Methodology for Research

Qualitative data collection

To collect data on which to test the previous hypotheses on we have interviews with business leaders in small and large firms. This method of qualitative data collection makes it possible to obtain rich explanations and descriptions of processes and makes it possible to see exactly which events lead to certain consequences (Miles & Huberman, 1994), albeit in the perspective of the interviewee. By interviewing business leaders in both small and large firms, we can see the situation from different perspectives and obtain relatively balanced real-world information.

The interview

The first part of the interview includes questions about who the interviewee is and what his firm and its activities entail. We then present the interviewee with 12 statements based on our factors which the interviewee can either accept or deny. The statements and the terminology used in them, such as *economies of scale* and *financial resources*, are explained to the interviewees beforehand to minimize confusion. The interviewee is stimulated to explain why he agrees or not and to give examples from practice. Finally, the interviewee is asked if he has experienced significant growth in his firm and if he experienced advantages or disadvantages from this growth. Complete transcripts of all interviews are available in the appendices of this paper.

The interviewees and their firms

A: The first interviewee (hereafter mentioned as A) is the leader of a small business unit, which is part of a larger industrial design firm. The industrial design company takes care of product development for clients requiring high level of technical knowledge and innovation. Innovation is at the core of its activities as the firm operates as the R&D department for many larger firms who do not have and/or cannot afford a department like it of their own. The business unit consists of 4 employees and the entire firm staffs around 100 employees. The yearly revenue of the business unit is EUR 300,000 to EUR 400,000 and of the firm itself is around EUR 10 million with around EUR 1 million of profits in 2009. Based on this data and the SBA's definitions (see § 2.1), the firm is considered small.

B: The second interviewee (hereafter mentioned as B) is a management consultant specializing in IT strategy and works at one of the largest gas and oil multinationals. Its activities include exploration and production of gas and oil and the sale of these to business and consumer clients. Innovations it has produced include extracting oil sands, managing CO₂ emissions through carbon capture and producing energy efficient fuels. The firm has over 100,000 employees and its yearly revenue amounts to USD 438 billion with USD 26.3 billion profits in 2008. Based on this data and the SBA's definitions (see § 2.1), the firm is considered large.

C: The third interviewee (hereafter mentioned as C) is the founder of an online independent music publishing platform. This platform has been partly responsible for an online revolution in independent music publishing in the 2000s, as it made it possible for independent musicians worldwide to publish, produce and sell their music CDs while removing record labels as the intermediary. Its core activity can therefore be considered an innovation itself. The firm employs 85 people and its revenue was USD 12 million with USD 4 million profits in 2008. Based on this data and the SBA's definitions (see § 2.1), the firm is considered large. However, the founder has experienced the firm both in its small and large phase.

5.4. Analysis

H1. "Large firms are able to develop products and innovations for a lower cost than small firms because they are able to spread out their research & development costs over more innovation projects (1a). Small firms are not able to do the same (1b)."

All interviewees disagreed with the statement. Economies of scale are present in most parts of large firms but the areas where innovation plays its part appear to be excluded from the rule. Innovation is not something that is easily formalized; simply investing in it does not guarantee success. A argues that it's actually the opposite: economies of scale are not present in large firms' innovation projects as the larger size of the firm only results in "sluggish development paths raising costs" for innovation. This argument is proven by Wakasugi (1997), finding diseconomies of scale in the areas of an organization concerning product development and by Arvantis (1997) who found economies of scale in Swiss manufacturing firms except in the departments where innovation happened. A argues that because there is so much more people involved in an innovation project at a large firm, it becomes difficult for the firm to clearly define the goals of innovation projects. C mentions another important point that "innovations do not need to [always] cost money" and that

therefore small firms are just able to keep costs low as large firms when working on innovation projects as long as they closely communicate with their customers to hear what they want from the firm. B agrees with C that it's not that large firms can innovate at lower costs but that they can run more projects and only need a few to succeed to profit, research confirm this effect (Cohen & Klepper, 1996). The interviewees however do not agree that large firms can produce innovations at lower costs. Based on these answers, we choose to reject H1.

H2. “Small firms experience lack of (financial or other) resources (2b) which large firms do have (2a), disabling them to pursue certain innovation projects”

The majority of the interviewees agree with this statement. A states that the costs of even simple product development quickly run high and small firms are often not able to develop new products for this reason. A argues that due to their easy access to capital, large firms have the advantage that they can invest for a long-term in an innovation project that will not profit until long in to the future. A's argument is confirmed exactly by Eitlie & Rubenstein's (1987) empirical findings which proves that small firms simply can not take on long-term innovation projects due to their resource limitations. B agrees and states that large firms are better equipped with the financial threshold and buffer to do more innovation projects. C did not experience it in his firm because the nature of the innovations in his industry did not require massive resources. Thus, it depends on the nature of the innovations the firm executes. Based on these answers, we do choose to accept H2 as the effect is visible in many industries although not all.

H3. “Large firms have more diverse resources (3a) than small firms. This makes it possible for them to execute a wider range of innovation projects than small firms which often have narrow and focused resources (3b).”

There is a mixed opinion about this statement. A agrees and states large firms have more diverse resources so that they can pursue a wider range of projects. This lowers their overall risk as opposed to small firms who often bet on one project to succeed. A and B both mention that large firms have more buffers for failure. A mentions that this effect actually forces his (small) firm to make sure their innovation projects work and succeed by implementing mechanisms like fail-safes, meaning that they can modify the product easily after production; something that large firms do not have to do, because they are betting on more projects. B agrees and states that large firms are better equipped with the financial threshold and buffer to do more innovation projects and thus only need a few projects to succeed to profit. B adds that it depends on the situation; in some cases focus (as in narrow resources) give you better results than differentiation (as in diverse resources). C does not see this effect directly in his firm, but this may be explained again by the nature of innovation in his firm; there was no need for a wide range of innovation projects as C's core business was an innovation. Therefore, based on these answers, we choose accept H3.

H4. “Large firms are able to make innovation a formalized task by fitting them into research & development departments (4a). Small firms are not able to do this because they do not have as many innovation projects (4b).”

There are mixed opinions regarding the truth of this statement. A agrees with the statement but does not see it as an advantage. Large firms are able to make innovation a formalized task but this does not mean they do a better or faster job. Instead, the interviewee argues small firms do a better and faster job at innovation than R&D departments in large firms because small firms can be lean and agile, which supports innovation output. B argues that the statement only holds truth if the firm has innovation or R&D as a strategic focus; it depends on the company. B states that his firm does have a strong focus on R&D and it therefore applies to his firm. C does not agree and argues that the smaller a firm is the better it is at innovation stating "There is no revolution without bloodshed. Any worthy change means old/existing ways need to be destroyed. Big organizations have a much harder time with that". Based on these answers we reject H4.

H5/H6. "Large firms are slower to respond to their environment (6a) and are more resistant to change due to high bureaucracy (5a) and formalized organization structures. Instead, small firms are rapid to respond to their environment (6b) and show agility due to short communication lines and low bureaucracy (5b)."

All interviewees agreed unanimously with the hypothesis. A argues that the short communication lines and low bureaucracy in small firms make fast goal determination possible, making it easier to quickly respond to a firm's environment. Instead, A states that large firms are sluggish and slow due to their size. B adds that because his company's size requires it to have many safety controls and procedures, a lot of red tape (or bureaucracy) is present which slows down its responsiveness. This red tape occurs due to an increase in bureaucratic structuring as shown by Stock & Greis (2002). C experienced this effect in a different way, when overnight he made changes to the sales price of his products without communicating the change to any other employees; the next day many employees approached him about the change and thought he was "insane" as they did not receive any update on the change. In the firms they previously worked at, 'countless' departments would have needed to approve the change and it would then take weeks to instigate such a price change. C had never done it differently. C would also hire new people in a matter of hours when large firms would have recruitment selections taking months, according to him his ways of handling the firm was much quicker and more efficient than how large firms do it. However, A and B believe large firms do not necessarily have to be slower to respond or be more resistant to change if they have the right organization structure. A mentions Apple as an example of a firm operating with many independent business units, emulating the agility of small firms. C believes the same and argues it has to do with the right leadership and firm structure. C mentions Southwest Airlines and Virgin Group, who also have structured their firm in small business units operating independently. Based on these answers, we choose to accept H5/H6.

H7. "Large firms implement more incremental innovations (7a) than radical innovations. Talking about actual radical new products being introduced, small firms are in general more inclined to do this (7b)"

All interviewees were indifferent or disagreed with this statement. A argues that it depends on the company: large firms have larger R&D resources and can therefore strive for more dramatic and more revolutionary innovation results than small firms and due to their long lifespan and long-term resource

capability are able to plan innovations over a longer time period. B argues that his firm supports both incremental and radical innovations. C does not agree and states that the size of a firm does not matter at all for the type of innovation. Based on these answers, we choose to reject H7.

H8/H9. “In small firms ownership and management are often the same (8b). Therefore, management can actually make long-term decisions which would be advantageous for innovation. In large organizations ownership and management are separated (8a), causing them to focus on short-term objectives like maximizing profits (9a) instead of focusing on innovation (9b). In addition, small firms appear to be more in touch with their product than large firms for these reasons.”

All interviewees unanimously agreed with this statement. A states that his firm rather works with small firms where ownership and management are the same, often family-owned businesses in his case, because they can have direct contact with the directors then who are able to quickly make (financial) resources available necessary for innovation projects. A says that large firms on the other hand have a financial manager, account manager and executives who all have different roles and different goals with regards to the innovation projects. A has recently experienced problems with a large multinational client where the support for a project changed over time in the organization: the account manager still believed in the project but the executives slowly killed it. This situation shows direct comparisons with the effect that is described by Crane (1997), who showed that firms in which ownership and management is separated focus on profit maximization instead of innovation. B agrees on this but adds that it depends on the strategic focus of the company. If a firm needs to innovate, its goals will be balanced somewhere between maximizing profits and innovation goals. C adds that in large firms, shareholders require managers to focus on profit maximization, while small firms may not be doing it for the money at all. In C's firm, where he was both the owner and manager, he decided what happened and he did not focus on profits, but instead focused on his and his employees' ideas. Based on these answers, we choose to accept H8/H9.

H10. “Small firms are more open to the outside world and more inclined to cooperate with other firms (10b) than large firms that are more closed and hardly cooperate (10a).”

A agrees and argues that this is because if a firm is small it requires more external support for things it can not execute internally such as manufacturing. In A's firm, products are designed internally but production prototypes and final manufacturing is executed by an outside firm for the simple reason that the firm is too small to be able to afford to do that themselves. Many large firms in A's industry are in fact able to do execute the entire production chain from design to manufacturing internally without cooperating with other firms. A's argument reflects the literature's position that a small firms' small resource base forces them to cooperate with other firms to make up for their lack in resources (Hitt, et al., 2001). B argues that large firms have less external dependency and therefore do not need to cooperate as much as small firms, which are often forced to cooperate because they need to acquire resources from outside. C does not agree and sees no relation, possibly due to the nature of his firm which is online music publishing which does not require a heavy resource base for innovation. Therefore, based on these answers, we choose to accept H10.

Extra question: Have you experienced growth in your firm (in employees or revenue) and did this create advantages and/or disadvantages for the firm's ability to innovate? If so, what were these?

B experienced a growth in revenue but this did not translate into more staff or innovations as the firm strategic focus was to cut costs and consolidate businesses. C experienced a growth in staff from 0 to 85 employees but did not feel it affected the firm's ability to innovate. C states that because he was the owner and manager, he was able to lead the firm as he wanted. C therefore believes it has more to do with the change in leadership and the change in the culture of innovation that occurs when a firm grows than the size itself. A agrees and mentioned Apple as an example of a large firm which still has a very innovative culture and a strong leader that appears to be more focused on producing innovative products than maximizing profits for shareholders.

Conclusion

After analyzing the answers from the interviews we have accepted hypotheses H2, H3, H5, H6, H8, H9 and H10 and rejected hypotheses H1, H4 and H7 which represented factors influencing innovation in relation to firm size. The final tested and proven factors of small and large firms influencing innovation is illustrated in figure 4.

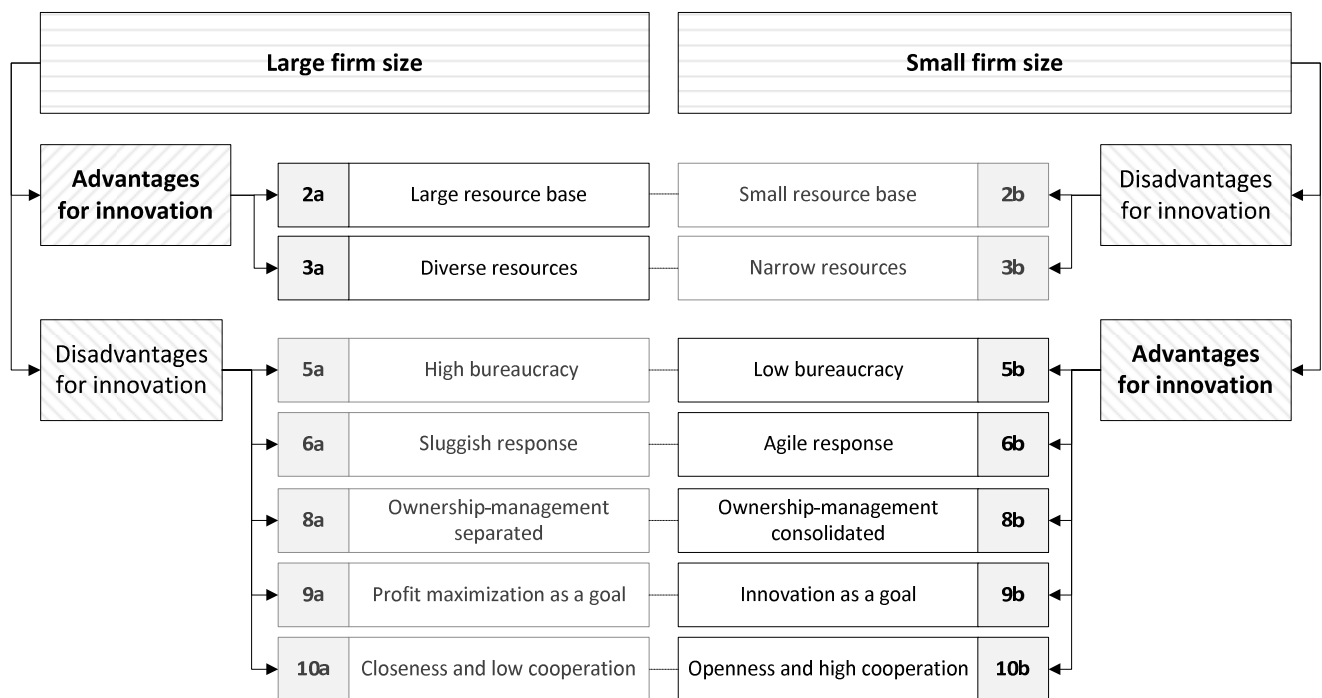


Figure 4: Tested and proven factors of small and large firms influencing innovation

6. Conclusion of Research

6.1. Answers to Research Questions

(A) How can firm size and innovation be defined?

Firm size and innovation are multidimensional and heterogeneous latent constructs and can therefore not be directly defined or measured. Literature deals with this by using manifest variables to define and measure them. For firm size, these variables are the physical capacity of a firm, the number of employees it staffs, the volumes of its (immaterial and material) input and output and its available financial resources. For innovation, these variables are the volumes of its (immaterial and material) R&D input, the number of registered patents and the number of innovations it introduces.

(B) What are the advantages of a large firm size for innovation?

The first advantage of large firms for innovation is their large resource base. Because large firms have access to more resources they can enter into more and larger innovations projects than small firms can. However, it does appear to depend on the nature of the innovations in a firm and its industry. For example, in capital intensive industries like gas and oil production, a large resource base is a prerequisite to innovate while in industries like music publishing a large resource base is not necessary to innovate. Overall however, it does appear to be a strong advantage in most industries as large firms are able to invest in and plan innovations over a longer period of time than small firms are, due to their access to resources. Many innovation projects only succeed after many years and small firms often do not have the resource base to cope with this, an effect confirmed by Eitlie & Rubenstein's (2007) empirical findings. The second advantage of large firms that was accepted is that they have more diverse resources. It appears that due to their diverse resources, large firms are able to execute a wider range and higher number of innovation projects and are less dependent on them to succeed because they are betting on more projects. On the opposite, small firms have the disadvantage of narrow resources due to which they have to focus on only a few innovation projects to succeed. Many times, a small firm's entire future depends on the success of one or a few projects and innovation is therefore a much more risky endeavour for them. They do not have the buffer for failure that large firms do have (Teece, et al., 1997).

(C) What are the advantages of a small firm size for innovation?

The strongest advantage for small firms is the effects their scale adds to the equation. Because they are so small, they hardly have bureaucratic problems and because of this can quickly respond to their changing environment: they are more *agile* than their larger counterparts. Large firms do not seem to be able to escape this disadvantage and thus are considerably slower to respond to their environment, the market and its competitors. In addition, small firms take more risk as they have less to lose and are therefore able to launch more radical innovations than large firms are. The fact that their ownership and management is often the same (few) people, means they can avoid focusing too much on profit maximization and instead make long-term innovation goals for which they can reserve the necessary resources. The fact that large firms are often publicly owned by shareholders means

their management is less in touch with their product and are more focused on satisfying shareholder's interests, which is maximizing profit while reducing risk (Hicks, 1935) than creating innovations and new products. In addition, what kills innovation in large firms is often that they operate in markets with a few players (oligopolies). In these markets firms strive to rationalize innovation and reward the people that cut costs, extend brands, manage mergers and acquisitions instead of the people that actually create the innovations. Due to the smaller scale of operations, employees in small firms are more in touch with production as they can often see their own contribution back in the final product. They are less concerned with making money as they are with making a great product. Therefore, small firms have a distinct advantage by actually *not* being able to operate in oligopolies. Small firms are forced to invest in possibly high-risk innovations because they operate more in highly competitive markets. If they do not innovate, they simply fail. For this reason alone, they are forced to innovate more. Finally, small firms have more incentive to cooperate with other firms, as they do not have the necessary resources to execute their projects on their own (Hitt, et al., 2001). In this respect, they become more open to input from and cooperation with other organizations which in turn can breed more innovation and create a less isolated organization which brings in more ideas from outside.

Extra findings: Large firms may overcome their disadvantages by mimicking small firms

Our findings suggest that large firms should be able to mimic the advantages small firms experience in innovation while removing the disadvantages associated with their size. There were two factors that we recognized to have an influence: organizational structure and leadership. Firstly, the organizational structure of a large firm can be transformed into smaller business units with their own objectives which operate almost independently from the rest of the firm. These units are able to reap the advantages of being just like small firms such as agility and low bureaucracy while also getting the advantages of a large resource base and having diverse resources that large firms experience. Secondly, strong leadership in a large firm which recognizes the importance of innovation as a goal and which can put in place the necessary resources for innovation might be able to overcome the ownership-management disadvantage which otherwise prioritizes short-term profits over long-term innovation goals.

6.2. Limitations

Due to the low sample size of this research of only three interviews, the significance of this research's results can be questioned. Additionally, data was gathered in a qualitative manner and could therefore not be statistically measured for significance. Finally, the questions in the interviews and the terminology used was explained to all interviewees beforehand, however we understand that subjective interpretation of the questions and their terminology may be possible and this is hereby considered as a limitation to this research.

6.3. Recommendations

It is clear that with regards to the relation between firm size and innovation, we are not close to any consensus in the literature. This may be because the question posed is too simplistic. The positive and negative relations were in fact dependent on which industries were studied. Large and small firms

appear to have both advantages and disadvantages for innovation, yet they do depend on the firm's industry and the nature of innovation. Thus, it appears that for some firms a smaller or larger size is more advisable than for others. Therefore, research should not so much focus on the relation between firm size and innovation but instead focus on the reasons why in certain cases innovation is negatively and in other cases it is positively related to firm size. If we can find these reasons and found them with empirical results, we have a research area from which managers can extract practical knowledge. This paper builds a foundation for this area of research by indicating the general advantages and disadvantages of firm size for innovation. Further research should be executed which empirically tests these findings for specific industries and types of innovations. In addition, testing should be executed in a quantitative method with a large sample size preferably in many firms in different industries to create a balanced perspective in the relation between firm size and innovation.

6.4. Implications

The sheer quest for growth that almost any organization of any size today has is not always the right strategy for each firm. This thesis shows that when an organization grows larger, its characteristics change and the scale that comes along with it offers both advantages and disadvantages. Evidence suggests that there are in fact types of innovations produced in which an organization might be better suited to scale down divide itself into smaller business units which can operate independently from each other, while for other types of innovations a large firm is required. Business leaders should make a concerted effort to choose the right size for their firm in their industry based on their innovation activities, because their innovation performance depends heavily upon it.

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