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Behavioural Additionality: An Innovation Orientation Perspective

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Abstract

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State of the Art

Governments commit substantial and ever increasing resources to science, technology and innovation policies, with the aim of positively influencing the innovative strategies and behaviours of firms (Wanzenbock et al, 2013). Behavioural additionality has emerged as a concept for evaluating the efficacy of these policies (Buisseret et al, 1995) however, this has been under-researched, with limited empirical examination (Clarysse et al, 2009). As a result, the uncertainty surrounding the existence and nature of these effects remains broadly unanswered.

Research Gap

Current research on behavioural additionality has found evidence of project, network and competence additionality (Knockaert et al, 2014). However, as acknowledged by Georghiou and Clarysse (2006), remarkably absent are studies of behavioural additionality in terms of firm's strategy and human resource behaviours. In addition, there is limited understanding of how grant support induces changes in firm's strategy and human resource behaviours which translate to changing attitudes toward innovation. Current research finds evidence for organisational learning (Clarysse

et al, 2009) and the moderating effect of some firm characteristics (Wanzenbock et al, 2013). However, examination has been limited to a small range of behavioural additionality effects. Therefore, further research is required to answer two questions. First, are behavioural additionality effects evident in terms of strategy and human resource behaviours? Second, how does organisational learning influence changes in attitudes toward innovation?

Theoretical Argument

We advance understanding of behavioural additionality by developing a conceptual framework to examine these questions through the lens of innovation orientation. Innovation orientation consists of the top management teams' attitudes toward innovation, risk and proactivity, the firm's strategic intentions to innovate and their human resource behaviours. We propose that the receipt of grant support induces behavioural additionality in terms of strategic intentions to innovate and human resource behaviours.

The conceptual framework also considers the interrelationship between organisational learning and changes in senior management team attitudes. Clarysse et al (2009) argue that organisational learning occurs as the firm enacts the changes that are recognised as behavioural additionality. This organisational learning leads firms to enact further changes, also recognised as behavioural additionality. We propose that behavioural additionality in terms of strategic intentions to innovate and human resource behaviours induces learning effects that influence changes in attitudes to innovation, risk and proactivity.

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Behavioural Additionality: An Innovation Orientation Perspective

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Abstract:

In pursuit of increasing firm's innovativeness, governments have committed substantial resources to innovation subsidies. Behavioural additionality emerged as a concept for evaluating the efficacy of these subsidies, however, this has been under-researched, with limited empirical examination. As a result, the uncertainty surrounding the existence and nature of behavioural additionality in terms of attitudes, strategy and human resources remains broadly unaddressed. Through a lens of innovation orientation, we present a conceptual framework and propositions specifying the nature and existence of these behavioural additionality dimensions. Our conceptual framework also incorporates legacy effects of innovation subsidies in terms of CEO attitudes, responding to the dearth of research in this area. We conclude by offering suggestions for further research.

Keywords: Behavioural Additionality, Innovation Orientation, Attitudes, Strategic Intentions, Human Resources.

Behavioural Additionality: An Innovation Orientation Perspective

In pursuit of increasing firm's innovativeness, governments have committed substantial resources to innovation subsidy programs (Czarnitzki and Lopes-Bento, 2013). The increasing need for justification of government expenditures, has placed a higher priority on evaluating the efficacy of these programs (Clarysse et al, 2009; Georghiou and Clarysse, 2006), to understand if subsidies achieve their aims, generate value for money or induce other unintended or unanticipated benefits (Georghiou, 1998).

Traditionally, interest focused on evaluating whether subsidies were complementary to private R&D expenditure or whether they 'crowd out' such expenditure (Cunningham et al, 2013). Initial evidence on input additionality was inconclusive (David et al, 2000) yet, advancements in addressing selection bias led to a rejection of crowding out¹, offering support for the positive influence of subsidies on firms' R&D investment behaviour (Henningsen et al, 2014; Hottenrott and Lopes-Bento, 2014). However, the dominant logic of only evaluating project inputs has been heavily criticised, for its failure to capture additional outputs generated by subsidies (Davenport et al, 1998).

Output additionality captures this, focusing on whether innovation outputs increase as a result of the subsidy (Georghiou, 2002). A growing number of studies evaluate output additionality, identifying positive effects on firms' patenting activities (Alecke et al, 2012), new product development (Hewitt-Dundas and Roper, 2010), and new product sales (Hottenrott and Lopes-Bento, 2014). However, this evolving logic has received criticism, for its failure to capture the more complex effects subsidies have on firms, in terms of influencing firm behaviour and strategy (Georghiou, 2002).

Buisseret et al (1995) proposed the concept of behavioural additionality, defined as changes that occur in firm behaviour and strategy as a result of a subsidy, to capture these effects. The concept's potential for explaining, more comprehensively, the influence of subsidies on firms, led policymakers to increasingly seek evidence on the existence and nature of behavioural additionality (Georghiou and Clarysse, 2006). However, despite this, current research has focused on a small range of behavioural additionality dimensions, predominately finding evidence for project implementation effects (Falk, 2007), competence effects (Knockaert et al, 2014) and networking effects (Afcha Chavez, 2011). These findings have greatly contributed to our understanding, however, due to this narrow focus, behavioural additionality "has remained a rather anecdotal observation, without much academic work to underpin its existence" (Clarysse et al, 2009; 1518).

¹An exemption is Wallsten (2000) who finds full crowding out on the U.S. SBIR program.

This has led to numerous calls for future research and experimentation in evaluation, to broaden understanding of, and address the uncertainty surrounding the existence and nature of many behavioural additionality dimensions (Cunningham et al, 2013; Edler et al, 2012). Most notable, are calls for studies on attitudes, firms' strategy and human resources, which despite being positively linked to innovation performance (Stock et al, 2014) have received limited attention (Afcha Chavez, 2011; Malik et al, 2006; Davenport et al, 1998; Buisseret et al, 1995). Thus, future research is required to understand if behavioural additionality effects are evident in terms of attitudes, firms' strategy and human resources.

Additionally, scholars have acknowledged the need to examine the persistency and legacy of behavioural additionality effects² (Clarysse et al, 2009; Malik et al, 2006; Gok and Edler, 2012). However, despite this, the persistency and legacy of behavioural additionality have been virtually unexplored (Cunningham et al, 2013; Georghiou, 2002), with the exception of Roper and Hewitt-Dundas (2014). Given 'persistence' and legacy are key aspects of behavioural additionality definitions (Gok and Edler, 2012) and omitting these effects may lead to inaccurate evaluations (Roper and Hewitt-Dundas, 2014), addressing the uncertainty surrounding their existence and nature is crucial to understanding behavioural additionality.

In this paper, we respond to these gaps, focusing on post subsidy³ behavioural additionality in terms of attitudes, strategy and human resources, and the legacy of these effects in terms of attitudes. We focus on addressing the uncertainty surrounding the existence and nature of these dimensions, through a lens of innovation orientation due to the lack of prior literature and policymaker's focus on increasing the long-term innovativeness of firms. Thus, we add to knowledge in three ways. First, we respond to the limited examination of behavioural additionality, through the development of a conceptual framework and propositions for examining under-explored behavioural additionality dimensions. Second, we respond to the limited examination of (potential) legacy of behavioural additionality (Cunningham et al, 2013; Roper and Hewitt-Dundas, 2014), through the development of propositions on organisational learning in short-term behavioural additionalities, leading to legacy effects in terms of CEO attitudes. Finally, we contribute to the limited theoretical base of behavioural additionality (Gok and Edler, 2012; Clarysse et al, 2009) through the introduction of the concept of innovation orientation. This contributes via offering a framework to capture whether innovation subsidies positively or negatively influence firm's long-term innovativeness.

²Legacy refers to further effects or benefits emerging from short-term additionally effects while persistency refers to the short-term additionally effects being sustained beyond the subsidy period.

³Behavioural additionality can be captured during project implementation, during the project and post subsidy. We focus on post subsidy effects in line with the broader literature. However, this has several limitations, namely, the omission of implementation and during project effects and possibly missing transient effects.

The article is structured as follows. We begin by reviewing behavioural additionality, and introducing innovation orientation. Next, we present our conceptual framework, which specifies the nature and existence of behavioural additionality in terms of attitudes, strategy and human resources, through an innovation orientation lens, and specifies the existence of legacy effects in terms of CEO attitudes. Following this, we explore each of the elements in more detail and offer propositions. We conclude with future research suggestions to enhance our understanding of behavioural additionality.

The Concept of Behavioural Additionality

Behavioural additionality emerged from early evaluations of R&D collaboration programs, when it was observed input and output additionality did not sufficiently capture the influence of subsidies on firms. Buisseret et al (1995; 590) seminal article defined it as “the changes in a company’s way of undertaking R&D which can be attributed to policy actions”. This definition drove early research, which focused on capturing behavioural additionality at the project level (Georghiou and Clarysse, 2006). Some support was offered for project additionality, which examines whether without support the project would have proceeded (Falk, 2007). However, it was found that firms rarely operate in this stop-go manner (Georghiou, 2004), but instead demonstrate partial project additionality, where receipt of an innovation subsidy results in more challenging projects, conducted faster, on a greater scale and with larger scope (Falk, 2006; 2007).

More recently, scholars have acknowledged that behavioural additionality is evident beyond project measures (Gok and Edler, 2012), with subsidies indirectly influencing firm’s wider innovation-related and general behaviours. To date scholars have mainly focused on cognitive capacity additionality (Bach and Matt, 2002; 2005), which is a sub-set of behavioural additionality, evaluating the influence of subsidies on firms’ competencies and networks (Knockaert et al, 2014). Clarysse (2006) found R&D subsidies to positively influence firms’ competencies in terms of management capabilities, networking skills and human resources. Other studies offered further support, in addition to finding improvements in firms’ product development competencies, technological competencies, and innovation management competences (Knockaert et al, 2014; Madsen and Brastad, 2006; Fier et al, 2006).

Most research has focused on networking, with evaluations quantifying the proportion of subsidized firms increasing their collaboration (Georghiou and Clarysse, 2006). For example, Davenport et al (1998) found 58% of firms increased their collaboration activities and Falk (2007) found 50-55% of supported firms enhanced their collaboration, with research institutes, other firms and their value chain, respectively. Similarly, Breschi et al (2009) found public support to significantly increase the chances that a firm will cooperate with a public research organisation and customers/suppliers, albeit at a lower increment. These findings have been

successfully replicated lending further support to network additionality (Afcha Chavez, 2011; Teirlinck and Spithoven, 2012; Kang and Park, 2012; Antonioli et al, 2014).

However, while these studies have greatly contributed to our understanding, they have focused on a small range of behavioural additionality dimensions, thus limiting knowledge of the influence of subsidies on firms (Cunningham et al, 2013; Clarysse et al, 2009). Capturing other possible dimensions is becoming increasingly important given the pressure on subsidy programmes to demonstrate value (Clarysse et al, 2009; Bartle and Morris, 2010) and positively contribute to the firms' current and future innovative efforts (Georghiou, 2002). The literature examining other (possible) dimensions of behavioural additionality is small, albeit growing, with studies emerging on strategy (Bayona-Saez et al, 2013) and human resources (Antonioli et al, 2014). Initial findings suggest subsidies positively influence firm strategy and human resources, yet the uncertainty surrounding the existence and nature of these behavioural additionality dimensions has yet to be addressed. For example, subsidies influence on human resources has predominately been captured through competence additionality, as to whether the company upgrade their human resources (Clarysse, 2006). However, while capturing the aggregate effect, this fails to understand which human resource policies, practices, or behaviours are stimulated.

Another area of interest has been the influence of subsidies on organisational attitudes, which is largely unexplored (Afcha Chavez, 2011; Davenport et al, 1998). Despite numerous scholars suggesting attitudinal additionality effects (Buisseret et al, 1995; Fier et al, 2006; Madsen and Brastad, 2006). The importance of capturing attitudinal additionality draws from attitudes influence on both current and long-term innovative strategies, behaviours and preferences (DITRA, 2006; Buisseret et al, 1995). That is, attitudes represent the predisposition of the firm to innovation, therefore, firms with less receptive attitudes to innovation are less likely to innovate, whereas those, with more receptive attitudes to innovation are more likely to innovate (Coronado et al, 2008). Accordingly, subsidies influencing attitudes, either negatively or positively, in addition to establishing a new dimension of behavioural additionality, would greatly contribute to our limited understanding of legacy effects (Roper and Hewitt-Dundas, 2014)⁴.

Thus, we develop a conceptual framework to examine the existence and nature of these dimensions of behavioural additionality. We frame our discussion through a lens of innovation orientation for two reasons. First, the dearth of prior literature provides little guidance on the possible nature of these dimensions. For example, while research suggests that subsidised firms improve their human resources (Knockaert et al, 2014; Clarysse, 2006) the policies, practices, or behaviours through

⁴In this paper we focus specifically on the influence of innovation subsidies upon attitudes, as oppose to attitudes influence on strategy and behaviour.

which this is achieved is less clear. Second, policymakers increasingly request evidence on how these changes influence the firm's longer-term innovativeness (Cunningham et al, 2013). Innovation orientation offers a framework to capture this, as it focuses on whether the configuration of attitudes, strategy and human resources positively or negatively influences firms' long-term innovativeness (Siguaw et al, 2006).

Innovation Orientation

Numerous studies explore firms' innovation process activities and the outcomes emerging from these activities (Homburg et al, 2002; Manu and Sriram, 1996). Yet less attention has been paid to "the propensity of an organisation to continually innovate as an organisational objective" (Siguaw et al, 2006; 556). It is argued that firms' innovation orientation significantly influences their propensity to innovate, with innovation-oriented firms producing greater innovation outputs (Siguaw et al, 2006; Stock and Zacharias, 2011). Innovation orientation originates in the attitudes of organisational members (Siguaw et al, 2006), specifically their top management team. However, due to varying degrees of managerial discretion and power (Finkelstein, 1992; Hambrick and Finkelstein, 1987), we focus specifically on the CEO (Kraiczy et al, 2014b). As the firms' most powerful actor, CEOs have the greatest level of discretion over resource allocations, and the greatest influence on firm strategy (Kraiczy et al, 2014b; Wang et al, 2014). Therefore, CEO attitudes will have the greatest influence on firm innovativeness⁵ (Chatterjee and Hambrick, 2007).

Attitudes such as tolerance for risk, and openness to and encouragement and support for new ideas, change and innovation are central components of innovation orientation (Hurley and Hult, 1998; Talke et al, 2011). These attitudes represent their positive or negative feelings toward crucial components of innovation. For example, risk averse attitudes or a preference for the tried-and-tested, may inhibit innovation, as risk and new ideas are integral components of the innovation process. Alternatively, risk tolerant attitudes and support for new ideas, may drive innovation within the firm, by orienting and guiding firms' strategy and actions toward innovation (Stock et al, 2014).

Other scholars have considered innovation orientation to represent the firms' strategic intentions to innovate (Worren et al, 2002), and innovation promoting and enabling human resource practices, policies and behaviours (Atuahene-Gima, 1996; Stock et

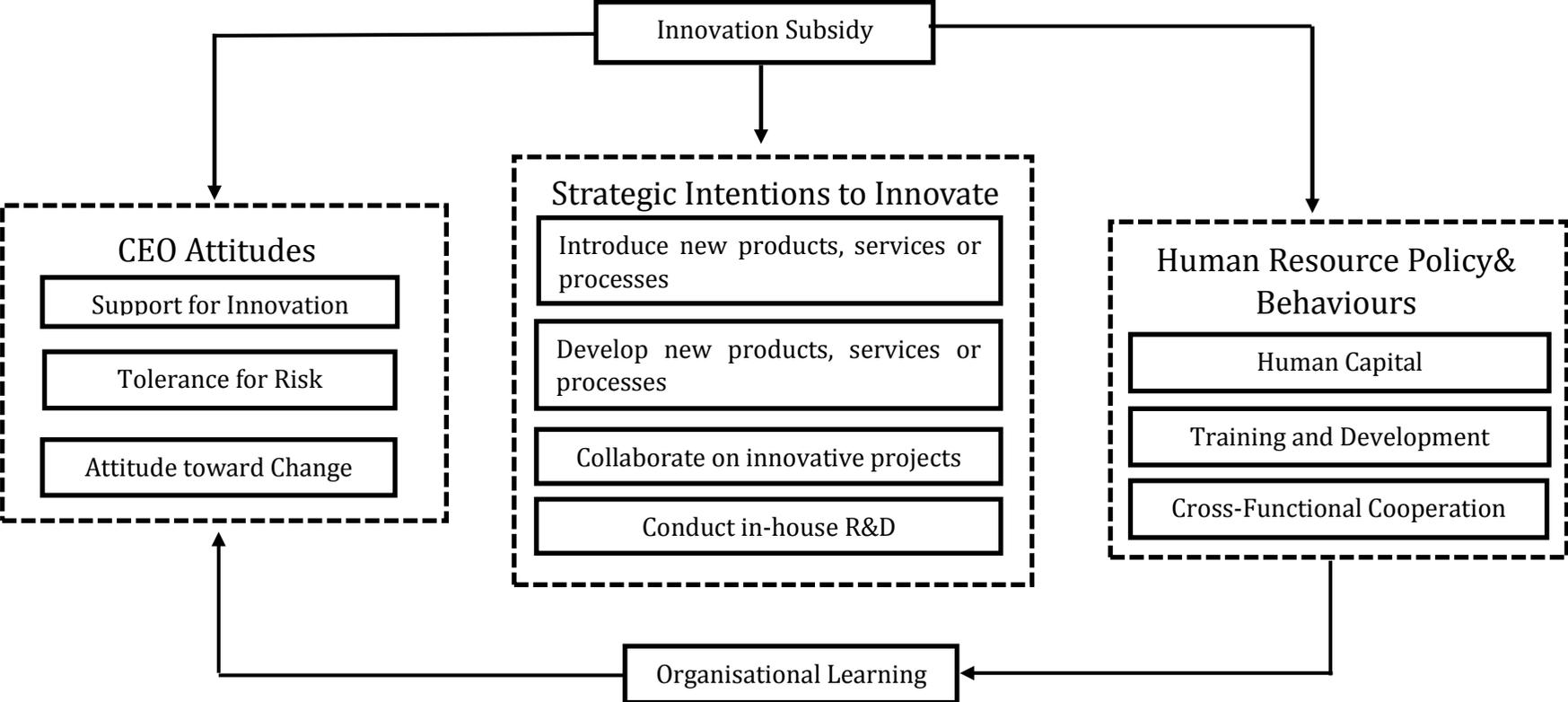
⁵The effect of the CEO, as an individual, on firm strategy and behaviour is influenced by firm size, with greater effects in smaller firms, than in larger. This is due to different levels of managerial discretion (Hambrick and Finkelstein, 1987) and power (Finkelstein, 1992), which determine the latitude of action available and their capacity to exert influence (Hambrick, 2007). In larger firms' given the presence of other top management and greater levels of organisational inertia, the influence of the CEO will be less, than in smaller firms' where the CEO operates more freely with less organisational inertia. Thus, in larger firms it may be necessary to capture the attitudes of other top management (e.g. R&D director) in addition to the CEO.

al, 2014), which are linked to increased innovation outputs (Siguaw et al, 2006). To date, these have been examined independently, however, scholars have called for more inclusive conceptualisations, to gain a fuller understanding of innovation orientation (Engelen et al, 2014). Given innovation orientation examines whether the configuration of organisational factors increases or decreases firm innovativeness and evidence supporting the significant influence of attitudes, strategic intentions and human resources on firm innovation performance (Hurley and Hult, 1998; Talke et al, 2011), we adopt a multi-dimensional understanding of innovation orientation. That is, we argue that innovation orientation consists of not only the top management teams' attitudes, but also how this is manifest in firm's strategic intentions, and human resource policies, practices and behaviours (Siguaw et al, 2006; Stock et al, 2014; Kraiczky et al, 2014a).

A Guiding Lens of Innovation Orientation

In the previous sections we have highlighted the small range of behavioural additionality effects examined and highlighted attitudes, strategy and human resources as under-researched and highly desirable areas to identify behavioural additionality, as they represent a firms' innovation orientation, which greatly influences their propensity to innovate (Siguaw et al, 2006). In this section, we introduce our conceptual framework to examine the nature, existence and legacy of these dimensions. The specific nature of these components is specified in Figure 2. As can be seen, attitudinal additionality refers to the CEO attitudes toward innovation, risk and change. Strategic intentions refer to the firms' intentions to introduce or develop new products, services or processes, or collaborate innovatively. Human resources refer to the provision of training and development, human capital, and cross-functional cooperation. Finally, our conceptual framework incorporated legacy effects of public support in terms of changes in attitudes, occurring through a learning effect. Each of these elements are now explored in more detail.

Figure 2: Conceptual Framework



Attitudinal Additionality

Attitudes have received substantial attention in the psychology and entrepreneurship literatures, due to their influence upon subsequent intentions and behaviour (Ajzen, 1991; Bohner and Dickel, 2011). Drawing on this, innovation literature has similarly devoted attention to the concept, with studies finding significant influences upon innovative behaviour and innovation outputs (e.g. Ettlé and O'Keefe, 1982; Scott and Bruce, 1994; Burcharth et al, 2014). Given the role of innovation subsidies is to positively increase firms long-term innovativeness, whether through increases in R&D expenditure or innovation outputs, or through behavioural or cognitive changes (Gok and Edler, 2012; Afcha Chavez, 2011), numerous scholars have suggested attitudes as an important behavioural additionality dimension (Buisseret et al, 1995; Georghiou and Clarysse, 2006; Madsen and Brastad, 2006). Yet, little to no attention has been paid to examining the existence or nature of this dimension. Thus, to understand how subsidies may influence attitudes we must first examine what attitudes are and how they are formed and changed.

Scholars agree that an attitude is an evaluation of the benefits and limitations of an object of thought (Bohner and Dickel, 2011). The outcome of this evaluation expresses whether organisational members feel positively or negatively toward an object (Robinson et al, 1991). This significantly influences their actions toward the object (Burcharth et al, 2014; Bohner and Dickel, 2011). However, at this point, two divergent views emerge on attitudes, the functional and constructionist perspectives⁶ (Gawronski, 2007). The functional perspective argues that attitudes are held in organisational members memory, as associative knowledge, which is automatically retrieved to respond to an attitude object (Eagly and Chaiken, 2007). Whereas, the constructionist perspective argues that organisational members have limited memory capacity to hold and retrieve infinite attitudes, thus organisational members form attitudes based on the importance and accessibility of available information within a given situation (Argyriou and Melewar, 2011). Both of these perspectives are considered in more detail.

In the functional perspective, organisational members form attitudes to organise, structure and summarise large amounts of object related information (Argyriou and Melewar, 2011). The attitude represents a functional summary of the rewards and punishments associated with the attitude object (Bohner and Dickel, 2011). These are formed after the first exposure to the object, representing enduring motivations to act, which are continually updated, through an ongoing thought process (Cohen and Reed, 2006). Once formed, or updated, attitudes lie in memory as associative knowledge, which when confronted with a stimulus, come to mind automatically, guiding thought and helping to direct behaviour (Cohen and Reed, 2006). The retrieval of an attitude

⁶Excellent discussions are offered by Bohner and Dickel (2011) and Argyriou and Melewar (2011).

is greatly influenced by its strength, and perceived importance, as well as whether it was acquired through direct experience (Argyriou and Melewar, 2011).

The constructionist view emerged to critiques of the functional perspective, which suggested that organisational members' lack the working memory capacity to hold and retrieve an infinite amount of attitudes (Bohner and Dickel, 2011). Instead, they argue attitudes are goal driven evaluative judgements constructed in the situation based on currently accessible information (Bettman et al, 1998), some of which may come from memory (Schwarz, 2007). The perceived importance of information to their goals, and the accessibility of the information available will significantly influence the attitude formed. Thus, in different situations different attitudes toward the same object may be formed, depending upon the information available. That is, in the constructivist perspective attitudinal formation and change occur through different sets of information being activated and considered at the time of evaluation (Bohner and Dickel, 2011; Schwarz, 2007). While attitudinal change under the functional perspective represents a change in organisational members' memory, it is similarly driven by the provision of new (important) information (Argyriou and Melewar, 2011). Finally, as agreed under both perspectives, direct experience of an attitude object, significantly influences attitude change and formation (Schwarz, 2007; Bohner and Dickel, 2011).

Attitudinal formation and change therefore occurs through the provision of new, important and accessible evaluative information, which is more influential when attained through direct experience (Bohner and Dickel, 2011; Schwarz, 2007). This suggests several mechanisms through which attitudinal additionality may occur. Attitudinal additionality may occur through direct experience of innovation projects funded by subsidy. Fier et al (2006) suggested that 'value' discovered through subsidised innovation projects, may lead to attitudinal additionality. Previous research suggests significant value occurs through projects, particularly through enhancements in innovation outputs (Hottenrott and Lopes-Bento, 2014). For example, Radas et al (2014) finds subsidies to significantly increase the number of innovations firms introduced and Albers-Garrigos and Barrera (2011) find subsidies to positively influence firm's innovation performance. Each of these additionality effects represents significant value to firms. Green and Cluley (2014) found 'value' generated through a radical innovation to result in managers and organisational members adapting their attitudes to innovation. Thus, we suggest organisational members drawing on the 'value' generated as important and accessible evaluative information (functional) may strengthen existing attitudes or construct new stronger attitudes in the situation (constructivist). Given organisational members directly experience the creation of value, a greater more significant influence on attitudes is expected (Schwarz, 2007).

Conversely, negative experiences in projects may create negative attitudinal additionality. Previous literature has acknowledged that in addition to the positive

behavioural additionality effects, negative additionality may occur (Georghiou, 2002; 2004; Cunningham et al, 2013). Suggested negative effects have been excessive risk-taking by firms, which leads to failure and the implementation of inefficient organisational routines (Roper and Hewitt-Dundas, 2014). Given, the uncertain nature of innovation and the high rates of failure associated with innovative projects (Garcia-Granero et al, 2014), it is highly likely that some negative effects will be generated through subsidies. Thus, organisational members drawing on this new evaluative information, may form new associative evaluations, and adapt existing or form new attitudes that are negative (Bohner and Dickel, 2011). As with positive effects, given organisational members would directly experience these negative effects, a greater more significant influence on the adapting of current or forming of new attitudes is expected (Schwarz, 2007).

Another potential avenue is the new evaluative information emerging from other behavioural additionality effects. The realisation of additionality involves change on the part of the firm, for example, in the number of partners a firm collaborates with (Teirlinck and Spithoven, 2012). Organisational members directly experience these changes, and through collaboration firms' gain access to new information and knowledge, with inter-organisational learning often occurring (Clarysse et al, 2009). Hence, we suggest organisational members drawing on this new evaluative information may adapt existing or form new attitudes toward collaboration or innovation (Burcharth et al, 2014), generating attitudinal additionality. As with the above mechanisms, organisational members that directly participate in these collaborations experience greater, more significant influences on their attitudes (Schwarz, 2007). Taken together, this offers support to suggestions that attitudinal additionality occurs from subsidies (Davenport et al, 1998; Afcha Chavez, 2011; DITRA, 2006). We now use innovation orientation to guide our propositions on attitudinal additionality.

Dimensions of Attitudinal Additionality

The attitudes influencing firms' innovativeness depend upon the innovation or innovative behaviour. For example, in an open innovation context, attitudes toward knowledge sharing, external knowledge generation and collaboration will be crucial (Burcharth et al, 2014). As innovation orientation refers to the firms' inclination to innovate generally, the concept focuses on attitudes toward innovation, risk and change. Positive attitudes to innovation, risk and change have been found to significantly influence R&D intensity (Kraiczy et al, 2014b) and firms' innovative capacity (Hurley and Hult, 1998). Alternatively, negative attitudes have been found to inhibit innovation with organisations, due to the risk and change involved, and a preference for the status quo (Naranjo-Valencia et al, 2011). Thus, attitudes to innovation, risk and change significantly influence a firms' ability to innovate, and are of interest to policymakers.

Support for Innovation

Scholars have focused on openness, encouragement and support for new ideas and innovation (Atuahene-Gima, 1996; Somech and Drach-Zahavy, 2013; Hurley and Hult, 1998). Attitudes to innovation shape how the CEO searches for and assesses new ideas or innovations within the organisation (Bohner and Dickel, 2011). Positive attitudes may reflect management actively seeking new ideas, which challenge existing attitudes and understandings, and readily accept and implement, if they represent improvements to current practices, processes or behaviours (Hurley and Hult, 1998; Siguaw et al, 2006). Alternatively, negative attitudes may reflect a screening out of such ideas due to the changes they would impose to practices, processes and behaviours (Burcharth et al, 2014).

The actions emerging from these attitudes convey signals to organisational members regarding expectations for innovation in their behaviour (Scott and Bruce, 1994). These signals influence the motivation and perception of employees as to the value placed on innovation within the firm, and thus direct the innovativeness of their behaviour (Yuan and Woodman, 2010; Gumusluoglu and Ilsev, 2009). Thus, CEO support for innovation significantly influences whether innovation is readily accepted within the firm, or there is a preference for the tried and tested, whether new ideas are actively sought, and whether sufficient resources and supporting practices will be put in place to support innovation and innovative behaviour (Hurley and Hult, 1998; Siguaw et al, 2006; Stock et al, 2014; Gumusluoglu and Ilsev, 2009). Drawing on our discussion of mechanisms for attitudinal additionality, we suggest that the provision of new information and direct experiences through participation in innovation subsidy programs, positively influences CEO support for innovation.

Proposition 1A: The new information and direct experience associated with receiving an innovation subsidy, positively influences CEO support for innovation, resulting in attitudinal additionality.

Risk-Tolerance

Attitudes to risk have received significant attention, with studies focusing on CEOs tolerance for risk and uncertainty, their proclivity to take risks and their support for risk-taking behaviour (Hurley and Hult, 1998; Kraiczy et al, 2014b). Previous research has established a close link between risk-taking attitudes and innovation (Garcia-Granero et al, 2014; Latham and Braun, 2009; Ling et al, 2008). This stems from the uncertainty intrinsic to innovation, and the associated high rates of failure (Tidd and Bessant, 2013; Leenders and Voermans, 2007). Innovation requires attention, resources, organisational labour and time, yet the returns from these investments are unknown and uncertain (Garcia-Granero et al, 2014). For example, Astebro (2003) shows a small range of innovations provide most returns, while most innovations fail or provide negative returns. This uncertainty and high failure rate,

often leads to risk-averse attitudes, with firms' preferring to invest in the tried-and-tested, and thus, under-investing in innovation (Martin and Scott, 2000). Alternatively, those with higher risk tolerances are more likely to invest in innovation, given the potential for high returns (Garcia-Granero et al, 2014).

Thus, given the CEO's discretion over resource allocations and significant influence on innovation strategy (Chatterjee and Hambrick, 2007; Kraiczy et al, 2014b), their tolerance for risk will influence the level of innovation undertaken and supported within the firm (Hurley and Hult, 1998; Garcia-Granero et al, 2014). That is, risk averse CEOs will be less likely to support and approve of innovation, whereas, risk tolerant CEOs will be more likely to support and approve of innovation (Kraiczy et al, 2014b; Ling et al, 2008). Moreover, as in attitudes to innovation, CEO risk attitudes influence the organisational members' propensity to innovate (Scott and Bruce, 1994), due to the uncertain outcomes of their innovations and potential punishments if they fail (Zhou and George, 2001). Drawing on our discussion of mechanisms for attitudinal additionality, we suggest that the provision of new information and direct experiences gained through participation in a subsidy program significantly influences attitudes to risk. Moreover, given subsidies reduce the cost of undertaking innovation, which reduces the associated risk, we suggest subsidies positively influence attitudes to risk. Thus:

Proposition 1B:The new information and direct experience associated with receiving an innovation subsidy, significantly influences CEO risk tolerance, resulting in attitudinal additionality.

Attitude to Change

Behavioural additionality and innovation in general involve change on the part of the firm (Damanpour, 1991), whether in the amount of resources allocated to R&D projects, the scale, scope or speed at which a project is undertaken or the number of external sources a firm collaborates with. Thus, attitudes to change or receptivity to change will influence whether and the extent to which a firm innovates, and whether they implement the changes recognised as behavioural additionality (Murovec and Prodan, 2009; Zhou et al, 2005). Moreover, as in attitudes to innovation and risk, CEO attitudes toward change influence the organisational members' propensity to innovate (Scott and Bruce, 1994), as they will determine whether the internal climate supports innovation (Damanpour, 1991). Thus, drawing on our discussion of attitudinal change, we suggest that the provision of new information and direct experiences gained through participation in a subsidy program (Argyiou and Melewar, 2011), positively influences attitudes to change.

Thus:

Proposition 1C: The new information and direct experience associated with receiving an innovation subsidy, positively influences CEO attitudes to change, resulting in attitudinal additionality.

Strategic Intentions

Strategy refers to the intended and emergent initiatives taken to achieve organisational objectives and generate value. Innovation strategy represents a core component of strategy, referring to how the firm intends and implements actions to acquire skills and knowledge for innovative activities, and develop and exploit innovations (Bayona-Saez et al, 2013). Buisseret et al (1995) first acknowledged strategy as a core dimension of behavioural additionality, arguing subsidies lead to changes in firms' innovation strategy. Since then evaluations have offered support for the positive influence of subsidies on strategy (Georghiou, 2007). For example, DITRA (2006) found 50% of subsidised firms' to change their commercial strategy and Fier et al (2006) found subsidies influenced 44% of subsidized firms' long-term business strategies. Similarly, Madsen et al (2008) found subsidies to influence strategy in terms of knowledge, market and technological search behaviours.

More recently, attention has moved to whether subsidies influence firm's innovation strategy, in terms of undertaking internal R&D only, external R&D only, or both, with Afcha-Chavez (2012) finding subsidies to positively influence the adoption of any of these strategies, over no R&D strategy. Extending this, Bayona-Saez et al (2013) examined the influence of different sources of subsidies on firms' make, buy and make-buy R&D strategies. They find regional funding to have no effect on strategy selection, while national and 'other' subsidies significantly influence each R&D strategy. Moreover, Hsu et al (2009) found subsidies to have significant effects upon strategic formulation behaviour, with subsidies stimulating firms to adopt explicit innovation and technology strategies and encapsulate these in their overall business strategy. These studies highlight the significant influence of public subsidies on firms' innovation strategy yet; these studies have all focused on the emergent initiatives of strategy, resulting in limited understanding of the influence of subsidies on strategic intentions.

Innovation orientation focuses on the intentions to innovate, as oppose to the emergent initiatives (Kundu and Katz, 2003; Worren et al, 2002; Siguaw et al, 2006). Previous research suggests that strategic intentions significantly influence the magnitude and nature of future R&D and innovation conducted within the firm (Tidd and Bessant, 2013; Crossan and Apaydin, 2010; Naranjo-Valencia et al, 2011; Becheikh et al, 2006). Strategic intentions refer to the firms' current and future plans for innovation, for example, whether they intend to develop or introduce new products, processes or services, or intend to increase their collaboration and use of

external knowledge to aid innovation activities. Thus, understanding if strategy influences strategic intentions provide insights into the legacy of subsidies and the influence on future firm innovativeness.

Bakhshi et al (2013) represents the only study to examine the influence of subsidies upon future innovation intentions. They find that firms receiving innovation vouchers, are more likely to engage in product and strategic innovation after 6 and 12 months. Yet, they find no significant differences between non-supported and supported firms' in terms of intentions to engage in process innovation and intentions to introduce new technologies. Despite mixed findings the study suggests subsidies positively influence firm's strategic intentions. Moreover, given previous studies suggest that innovation subsidies significantly influence the emergent initiatives of firms; it is logical that they influence the intended initiatives also. Thus, we suggest behavioural additionality occurs from subsidies in terms of strategic intentions.

Numerous behavioural additionality studies suggest subsidies to positively influence the collaboration behaviour of firms (Falk, 2007; Breschi et al, 2009; Fier et al, 2006; Afcha Chavez, 2011; Tierlinck and Spithoven, 2012). Also, significant evidence exists on the positive influence of subsidies on R&D expenditure (Czarnitzki and Lopes-Bento, 2013; Henningsen et al, 2014). This suggests that subsidized firms utilise both internal and external R&D and knowledge in their innovation activities. Bayona-Saez et al (2013) and Afcha Chavez (2012) offered support for subsidies positive influence on firms' emergent collaboration and R&D strategies, suggesting they also influence intended strategies (Bakhshi et al, 2013). Accordingly, we propose that subsidies positively influence firms' strategic intentions to engage in collaboration, and to undertake in-house R&D activity.

Proposition 2: Receiving an innovation subsidy positively effects firms' strategic intentions to collaborate on innovative projects within the next 12 months.

Proposition 3: Receiving an innovation subsidy positively effects firms' strategic intentions to conduct in-house R&D within the next 12 months.

Furthermore, it is argued that resources allocations are a reflection of the firms' strategic intentions to innovate (Siguaw et al, 2006). Thus, the significant evidence on the positive influence of subsidies on R&D expenditure (Czarnitzki and Lopes-Bento, 2013; Henningsen et al, 2014), suggests that subsidies for innovation influence the firms' strategic intentions to introduce and develop new products, processes and services. Thus:

Proposition 4: Receiving an innovation subsidy positively effects firms' strategic intentions to develop new products, services or process within the next 12 months.

Proposition 5: Receiving an innovation subsidy positively effects firms' strategic intentions to introduce new products, services or process within the next 12 months.

Human Resources

Employees are involved in and critical to the success of all organisational activities (Jimenez-Jimenez and Sanz-Valle, 2008). Their importance comes partly from their human capital (consisting of their skills, experiences, abilities and knowledge (Ployhart et al, 2014)) being a critical organisational resource for innovation (De Winne and Sels, 2010). Firms draw on their employees' human capital in their innovation efforts, with employees applying their relevant experiences and knowledge to accomplish their innovative related tasks (Colombo and Grilli, 2005). It is argued individuals with more or greater human capital will achieve more desirable outcomes than those with low or less human capital (Marvel and Lumpkin, 2007). Thus, influencing human capital has been a key aim of policymakers (Bach and Matt, 2002; Antonioli et al, 2014).

Evaluative attention has been devoted to examining the existence of cognitive capacity additionality, which captures changes in human capital (Bach and Matt, 2002; 2005). Significant evidence has been found to support the positive influence of policy on firms' cognitive capacity (Knockaert et al, 2014; Fier et al, 2006; Clarysse, 2006), with studies finding enhancements to managerial capabilities, human resources and networking skills. Similarly, the seminal OECD studies found significant evidence of improvements in managerial competence (Madsen and Brastad, 2006) and the undertaking of more challenging R&D activities (DITRA, 2006; Fier et al, 2006). This suggests that through participation in subsidy programs, firms' enhance the competences and skills of their employees (Georghiou and Clarysse, 2006; Antonioli et al, 2014). Moreover, given evidence of learning and collaboration occurring through subsidy programs (Clarysse et al, 2009; Bayona-Saez et al, 2013), it can be inferred that firms' acquire new knowledge. Thus, given human capital increases as employees' acquire new experiences and knowledge (Marvel and Lumpkin, 2007), we offer the following proposition:

Proposition 6: Participation in an innovation subsidy program increases firms' human capital.

In addition to direct effects observed on human capital, scholars have suggested that subsidies may influence firms human resource policies and practices (Antonioli et al, 2014; Marzucchi and Montesor, 2012; Wong and He, 2003). Firm's human

resource policies and practices significantly influence the development of human capital (Beugelsdijk, 2008; Kang et al, 2007; Shipton et al, 2006). Particularly, training and development, which positively influences human capital development and firm innovation (Beugelsdijk, 2008; Sung and Choi, 2014). This stems from the skills, knowledge and experiences developed through training and development, which reinforces and enhances employees' innovative abilities and requisite job skills and expertise (Sung and Choi, 2014; Stock et al, 2014; Atuahene-Gima, 1996). Current evaluations suggest that firms improve their innovation management practices, increase their commitment to innovation and their understanding of the benefits of innovation and R&D through subsidy participation (Clarysse, 2006; DITRA, 2006). This suggests that firms may increase their allocations of resources and support to innovative enabling initiatives, such as training and development of researchers and employees, to enhance their technical and innovative skills (e.g. problem solving and creativity), and provide new knowledge that contributes to the firms' innovative efforts (Marzucchi and Montresor, 2012; Antonioli et al, 2014; Stock et al, 2014; Atuahene-Gima, 1996). Thus:

Proposition 7: Receiving an innovation subsidy positively influences the magnitude and innovation-orientation of training and development offered to employees.

Innovation is increasingly considered a collaborative process of idea generation and implementation, which builds upon different resources, skills and personnel (Cuijpers et al, 2011). Through collaboration firms' acquire new ideas and access to new resources and expertise. The integration of this external knowledge with their internal knowledge enhances the knowledge base from which they can innovate (Lichtenthaler, 2011). This provides new knowledge stocks for innovation, leading to the knowledge spillovers and cross-fertilisation of ideas linked to innovation. Reflecting increasing evidence that few firms' rely exclusively on their internal knowledge and R&D activities (Spanos et al, 2014; Laursen and Salter, 2014), behavioural additionality scholars have focused upon inter-organisational collaboration.

The seminal OECD studies (Georghiou and Clarysse, 2006) found significant network additionalities emerging from innovation subsidies. Later studies have also supported the significant influence of subsidies on firms collaboration (Breschi et al, 2009; Afcha Chavez, 2011; Kang and Park, 2012; Antonioli et al, 2014). However, the focus on inter-organisational collaboration, omits cross-functional collaboration, which innovation orientation literature suggests to significantly influence firms innovation activities (Stock et al, 2014; De Clercq et al, 2011). Cross-functional collaboration positively influences innovation activities, by enabling firms R&D and innovation departments, to acquire new ideas and access new resources and expertise embedded in different functions (Enz and Lambert, 2012; Cuijpers et al, 2011; De Clercq et al, 2011). As with inter-organisational collaboration, this requires exchange of

information and coordination of activities across independent departments (Stock et al, 2014), which is often difficult (De Clercq et al, 2011). Human resource policies and practices that promote cross-functional R&D cooperation are key to overcoming these difficulties, guiding employees' behaviour and facilitating cross-functional R&D (Stock et al, 2014; Shipton et al, 2006; Siguaw et al, 2006). Given the significant influence on inter-organisational collaboration, it seems logical that subsidies will influence cross-functional collaboration also. Thus:

Proposition 8: Receiving an innovation subsidy positively influences cross-functional R&D cooperation.

Proposition 9: Firms' that receive an innovation subsidy, will adopt policies and implement practices that encourage and enable cross-functional R&D cooperation.

Legacy of Behavioural Additionality

Despite the small range of behavioural additionality effects examined, evaluations have yielded significant evidence as to the effectiveness of innovation subsidies (Cunningham et al, 2013; Antonioli and Marzucchi, 2012). However, to date most have focused on capturing the ex-post effectiveness of subsidies, limiting knowledge on their longer-term effectiveness (Clarysse et al, 2009). Increasingly scholars have acknowledged the need to examine the legacy of behavioural additionality (Cunningham et al, 2013; Georghiou, 2002; Malik et al, 2006 Gok and Edler, 2012; Roper and Hewitt-Dundas, 2014), to understand if the changes persist or further legacy effects occur, or if effects are limited to the subsidy period. Given increasing pressure on policies to demonstrate value (Clarysse et al, 2009; Bartle and Morris, 2010), and positively contribute to the firms' current and future innovative efforts (Georghiou and Clarysse, 2006; Georghiou, 2002), addressing the uncertainty surrounding the existence and nature of legacy effects is of paramount importance.

Roper and Hewitt-Dundas (2014) have provided initial insight, evaluating whether the innovation benefits derived from short-term additionality measures (input, output and behavioural), differ for subsidized and non-subsidized firms. For example, do levels of graduate employment (congenital additionality) have greater effects on innovation sales for firms' that received an innovation subsidy in the prior three years, than for those that didn't? Using panel data for Irish manufacturing firms, they find legacy effects in terms of the congenital and inter-organisational learning dimensions of behavioural additionality for new product development subsidies, but not for R&D subsidies. Thus, offering some support that innovation subsidies induce legacy behavioural additionality effects.

It is well acknowledged, that changes recognised as behavioural additionality occur through organisational learning (Roper and Hewitt-Dundas, 2014; Clarysse et al,

2009; Falk, 2004). As noted earlier attitudes are learned through new (important) evaluative information becoming available (functional) or constructed in the situation based on accessible evaluative information deemed important (constructivist) (Bohner and Dickel, 2011). Also, that gained through direct experience has a greater influence. Drawing on our earlier propositions, we suggest the changes recognised as behavioural additionality (postulated as) occurring in human capital, training and development, and cross-functional collaboration, results in new (important) evaluative information becoming available for the CEO as to the benefits/disbenefits of innovative initiatives. This leads to an adapting of current (functional) or the forming of new attitudes (constructivist), thus legacy attitudinal additionality. Moreover, given CEO's directly experience the implementation of these changes, literature suggests a significant influence on attitudes (Schwarz, 2007; Argyiou and Melewar, 2011). Thus:

Proposition 10: The new evaluative information stemming from the behavioural additionality in terms of human capital, cross-functional cooperation and training and development, results in legacy attitudinal additionality effects in CEO attitudes to innovation, risk and change.

Contributions of the Framework and Conclusions

Our conceptual framework makes several important contributions to literature. First, we respond to the small range of behavioural additionality dimensions examined (Cunningham et al, 2013), through the development of a conceptual framework and propositions for examining new dimensions of behavioural additionality in terms of attitudes, strategic intentions and human resources. We conceptualise these behavioural additionality dimensions, using innovation orientation due to the increasing emphasis on understanding the influence of subsidies on current and long-term firm innovativeness. Thus, we secondly contribute to the limited theoretical base of behavioural additionality (Gok and Elder, 2012), and through this, to understanding of how subsidies influence firm's innovativeness.

Through this, we offer the first conceptualisation of attitudinal additionality, specifying the nature of this dimension, and the processes through which it occurs. We propose that new information gained through direct engagement with an innovation subsidy (Argyriou and Melewar, 2011; Bohner and Dickel, 2011), results in positive attitudinal additionality, in attitudes to innovation, risk and change. Moreover, we propose behavioural additionality in terms of strategic intentions, human capital, cross-functional R&D cooperation and training and development, extending existing evidence on subsidies influencing emergent strategy and cognitive capacity additionality.

These offer new areas for identifying behavioural additionality, which would contribute greatly to our understanding of the concept, and to justifying the increasing resources allocated to innovation subsidies. Thus, future research should empirically

examine these dimensions, in addition to examining other aspects of these dimensions (e.g. attitude to proactivity), and other behavioural additionality dimensions (e.g. technology behaviour). This is needed to address the dearth of evidence on the concept and broaden our limited understanding of the influence of subsidies upon firms.

Third, we respond to the limited examination of the legacy of behavioural additionality (Roper and Hewitt-Dundas, 2014). We do this through the development of propositions on organisational learning in short-term behavioural additionalities, leading to legacy effects in terms of CEO attitudes. Thus, we offer new insights on legacy behavioural additionality. As acknowledged by Roper and Hewitt-Dundas (2014) and Cunningham et al (2013) understanding if legacy effects exist is crucial to better understanding the influence of subsidies upon firms'. Thus, future research should empirically examining the legacy effects in attitudinal additionality identified here, as well as other behavioural additionality dimensions.

Finally, as highlighted earlier, the importance of CEO attitudes draws from their influence upon firm strategy and behaviour. The implication of this is that different attitudes to innovation, risk and change, will lead to different treatments effects in firm strategy and behaviour. That is, the influence of subsidies upon firms is not uniform (Lee, 2011), with Wanzenbock et al (2013) finding (some) firm and R&D characteristics to result in differential treatment effects (Wanzenbock et al, 2013). Thus, future research should empirically examinewhether CEO attitudes influence the responsiveness of firms' to subsidies. It is hoped the conceptual framework developed here and the future research areas identified provide fertile ground for further development of our understanding of behavioural additionality.

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