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Innovation and regional development via the firm's core competence: some recent evidence from North East England

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ABSTRACT

This paper examines the nature of linkages between core competence of a firm and key characteristics of its product/output and thus presents an alternative theoretical framework for innovation and regional development. Within this framework, it is the externally observable characteristics of what a firm produces, rather than its internal functions, that establishes whether a distinct core competence potentially exists, in order to operationalize it for R&D and innovation activities. To demonstrate potential applications of this framework, a literature-based- questionnaire was designed to collect primary data from 330 firms located in North East England, a peripheral region of the UK. Collected data were subjected to a detailed statistical analysis to estimate the conditional probability that a firm has a core competence, given the presence of one or more of its key output/product characteristics. Based on this approach, the paper presents a theoretical/empirical framework for the promotion of innovation via enhancement of a firm's core competence, and improvement in its output/product characteristics. This framework might be employed as a strategic management tool (1) by a firm to help in allocation of scarce resources for innovation and innovation management and (2) by regional policymakers for targeting and assisting firms in peripheral regions to enhance regional development via firms' innovation and exporting activities.

Introduction

What is the nature of linkages between a firm's core competence and key characteristics of its output/product? How can a firm's strategy for innovation and growth be set via improvement of its core competence and characteristics of its output/product? Moreover, how can policymakers in a peripheral region help to enhance regional growth via these activities? This study seeks to provide practical answers to these questions. It does this task by critically reviewing key contributions in this field to develop a theoretical framework and a classification system within which these questions might be addressed.

A good starting point for this review is the concept of a firm's core competence. A firm's core competence might be viewed as a firm's knowledge, knowhow, and skills, and it acts in precisely the same way as tacit knowledge does in aggregate growth models (Romer, 1990). That is its development, and refinement would lead to innovation activities and results in a firm's sustained growth over time (Bonjour & Micaelli, 2010). However, core competence is a multifaceted theoretical concept, and it is often vaguely defined and hence difficult to identify and measure in practice (Schreyögg and Geiger, 2007; Hafsi and Thomas, 2005; Ljungquist, 2007). It involves several key internal processes for it to be created within a firm/organization. These internal processes include collective learning, effective communication, coordination of production skills, and capability to integrate multiple technologies (Prahalad and Hamel, 1990). Improvement in each of these internal processes, on their own, help to raise the level of knowledge, skills, and know-how within an organization, and when they are effectively managed and integrated, these processes collectively help to create core competencies that are difficult for rival organizations to replicate. These distinct competencies would give an organization/firm not only competitive advantage over their rivals but also an innovative advantage, enabling a firm to achieve sustained growth and exporting activities via continuous refinement of its core competencies over time (Seddighi, 2015; DeNisi, Hitt, & Jackson, 2009; Bogner, Thomas, & McGee, 1999).

Despite difficulties to identify and measure a firm's core competence in practice, there have been many attempts to devise practical procedures for its identification in the literature (Hafeez, Zhang, & ve Malak, 2002; Mascarenhas, Baveja, & Jamil, 1998; Javidan, 1998). Many authors appear to have developed their own distinctive processes; for example, Petts (1997) identified and encapsulated six elements of core competence components focusing on the sustain-

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ability of a firm. In a similar vein, Javidan (1998) suggested eight hierarchical criteria to identify a firm's core competence from a managerial perspective. Hafeez et al. (2002) developed an identification process focused on collectiveness and uniqueness. Later, Yang, Wu, Shu, and Yang (2006)) developed a systematic and meticulous process covering a large number of capabilities. However, this framework demands enormous resources and analytical methods, and for these reasons, is not considered to be a practical solution for the identification of a firm's core competence (Ljungquist, 2007). Other attempts in this area, for example, frameworks based on continuous upgrading and reconfiguring of a firm's capability suggested by Bonjour and Micaelli (2010), are also found to be challenging to apply in practice (Ljungquist, 2007,2010; Zoiopoulos, Morris, & Smyth, 2008).

These attempts have mainly been focussed on the evaluation of various internal processes/functions of a firm and their operations in practice. However, internal processes are often complicated, and their assessment is a difficult task in practice. As a result, despite these attempts, currently, there exists a clear gap in the literature as to how the concept of the firm's core competence might be used and operationalized in practice. In this study, we aim to add to the theoretical and empirical literature in this field by taking an alternative approach to the operationalization of this concept. In particular, instead of focusing on internal processes/functions for operationalization of core competence, we will be examining key output/product characteristics and their potential linkages with the firm's core competence to operationalize this concept as a management- decision-making tool for innovation activities. To this end, we have followed the pioneering work of Prahalad and Hamel (1990) and focused on the linkages between a firm's core competence and key output/product characteristics identified by these authors. This theoretical framework will be shown to provide a practical strategic management tool to help in the allocation of scarce resources for innovation and growth at a firm level.

To demonstrate its practical applications, we have applied it to a sample of firms located in North East England. The choice of this region as the sampling frame of this study is not accidental. This peripheral region has been lagging behind other regions of England, notably North West and South East regions, in innovation, R&D, and exporting activities, registering the lowest incidence of these activities in recent years (NELEP, 2016b; Duke, Hassinik, Powell, & Puukka, 2006; Seddighi, 2015). Given the predicted adverse impact of Brexit on the North East economy (NELEP, 2016b), there appears to be an urgent need for a practical strategic management tool that firms, as well as, regional policymakers can use to enhance regional growth via innovation and exporting activities.

The structure of this paper is as follows: In Section.1, we examine the nature of linkages between a firm's output/product's characteristics and its core competence and attempt to develop a theoretical framework for an empirical investigation. In Section. Two, we discuss this study's questionnaire, its sampling frame, and data collection method. In Section. Three, we present some empirical results and based on these, present a strategic management tool and demonstrate how it might be employed in practice, finally, in Section. Four, we offer a summary and conclusion.

Towards development of a theoretical framework for innovation and growth

In a pioneering work on the concept of a firm's core competence, Hamel and Prahalad (1990) suggest that a firm's core competence should generate output/product characteristics of (1) value- generation, (2) inimitability and (3) ease of access to a wide variety of markets. That is a theoretical /empirical relationship might exist between a firm's key product/output characteristics and a firm's

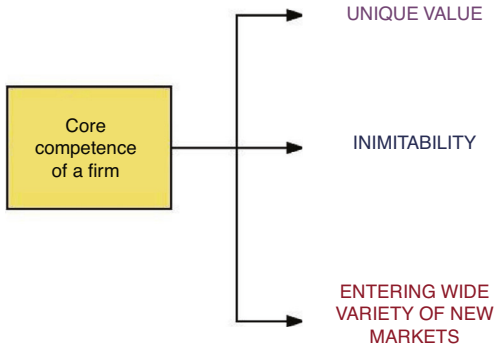

Fig. 1. A firm's core competence and its output/product characteristics.

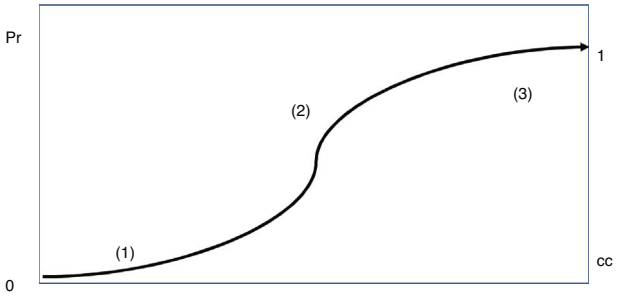

Fig. 2. Relationship between probability of a firm's core competence and an output/product characteristic.
(cc, core competence of a firm; Pr, Probability).

core competence. This proposition is supported by current literature (see for example Gokkaya and Ozbag, 2015; Bonjour & Micaelli, 2010; Srivastava, 2005; Hafeez et al., 2002; Agha, Alrubaiee, & Jamhour, 2012; Gilgeous and Parveen, 2001; Hafeez & Essmail, 2007; Jabbbouri and Zahari, 2014; Sisman, Gemlik, & Yozgat, 2012). Fig. 1 depicts this relationship, under the underlying assumption that, the presence of one or more of the above output/product characteristics is likely to be associated with the presence of core competence. This is a classification problem, as a firm either has a distinctcore competence or not given its output/product characteristics, however, using this framework, it is possible to estimate the conditional probability that a firm has a core competence, given the presence of one or more of these output/product characteristics. For this purpose, we have formulated a logistic probability function, Fig. 2, in an attempt to replicate various phases that might occur in the interaction between a firm's core competence and each one of these output/product characteristics. Stage (1) is indicative of a low probability of a firm having a core competence, for a given value of each one of the aforementioned characteristics, Phase (2) is an active phase, in this phase, the conditional probability of a firm having a core competence rises at an increasing rate, until it reaches phase (3), where an output/product characteristic is well developed, and a firm has a high probability of having a distinct core competence. Once phase (3) is reached, this probability remains high but stable and no longer increases. These dynamic phases are shown in Fig. 2.

Within this theoretical framework, it is the externally observable characteristics of what a firm produces, rather than its internal functions, that establishes whether a core competence potentially exists, in order to operationalize it for R&D and innovation activities. This approach to operationalization of the firm's core competence is radically different from conventional theoretical approaches which, by and large, have been focussing on the evaluation and enhancement of internal processes and functions of a firm for identification and development of its core competence. These

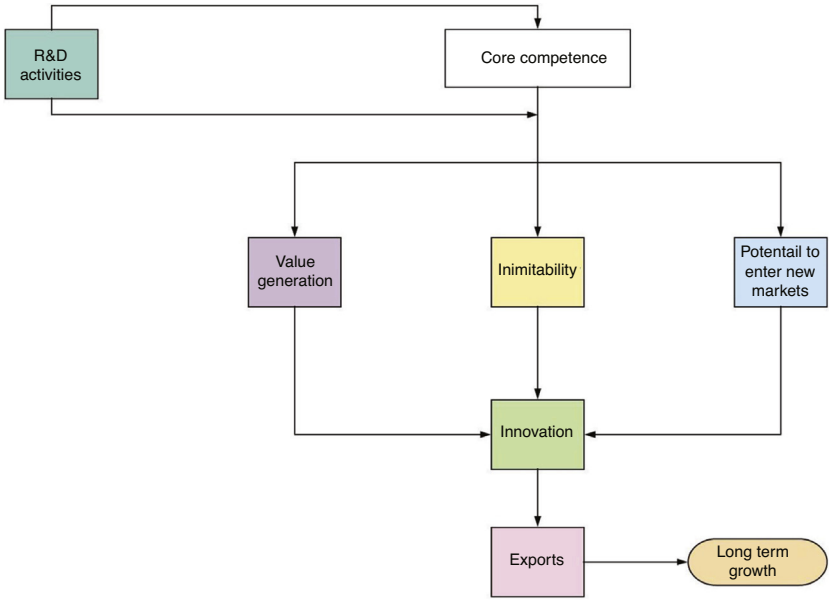

Fig. 3. Theoretical framework.

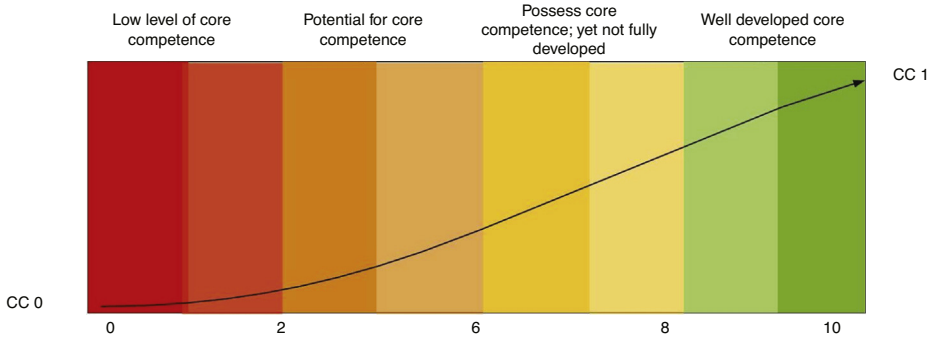

Fig. 4. Core competence - spectrum of firms.

frameworks are difficult and costly to apply in practice, and have been shown to be incapable of directly operationalizing the concept of firm's core competence for innovation in practice (Ljungquist, 2007,2010; Zoiopoulos et al., 2008).

Within our framework, a firm's strategy for growth is based on improving its core competence over time in order to facilitate innovation and exporting activities. This is done via R&D activities, which are mainly targeted at improving the aforementioned output/product characteristics, given the relationship between these characteristics and the firm's core competence within this theoretical framework. Fig. 3 presents a pictorial version of this theoretical framework.

One can generalize this theoretical framework to classify firms into various categories according to the value of the conditional probability that a Logit regression model would generate to provide a practical classification system for strategic management and policy initiatives to assist firms in their innovation activities. Fig. 4 presents a pictorial demonstration of this type of classification system. In this hypothetical example, a green segment of the grid (scores of 8–10) indicates those firms with a high probability of having a distinct core competence. and thus a high innovation/exporting activities; yellow grids represents (scores of 6–8) those firms that possess core competencies that are not yet fully developed. Orange segments (scores of 4–6) indicate those firms that have a good potential to develop core competencies. Finally, red (scores of 0–4) indicates those firms, which have a low probability of having/developing a core competence, given the status of one or more of their output/product characteristics.

Questionnaire and data collection method

Questionnaire

Table 1 presents a list of variables that are used in this study and a corresponding questionnaire.Data for each varible was collected via a literature -based questionnaire which was carefully designed for this purpose (See Table 1).

Data collection

Data were collected via a sampling frame consisting of firms listed in NORTH East England Process Industry Cluster (NEPIC) and North East England Chamber of Commerce (NECC) directories which together cover 3300 production-based firms in North East England. To ensure generalizability and to avoid bias in the data, a systematic stratified sampling method was used in this study. Furthermore, to generate a 95% confidence level for various statistical tests to be carried out later, the minimum sample size required for a population of 3,300 was determined to be 330 firms. However, the actual sample size was determined as 1100 firms to allow for

Table 1
List of variables and a questionnaire.

Variables	Question	Literature
Ownership status of a firm	What is the nature of the ownership of your firm?	Dixon and Seddighi (1996); Seddighi and Huntley (2007)
Date of establishment of a firm	How old is your firm?	Dixon and Seddighi (1996); Seddighi and Huntley (2007)
levels of Sales of a firm	What is the turnover of your firm?	Dixon and Seddighi (1996);
Status of the core competence of a firm	Does your firm have a core competence on which it concentrates many of its resources/activities?	
Value Generation characteristic.	Have you ever developed/added unique value to a product or service to which customers are attracted to/ willing to pay extra	Prahalad and Hamel (1990); Clark (2000); Gilgeous and Parveen (2001); Jabbouri and Zahari (2014); Hafeez et al. (2002); Sanchez and Heene (1997); Özbağ (2013); Sisman et al. (2012)
Inimitabilitycharacteristic	Does the firm have intensive organizational learning so that you do not struggle when a key employee leaves the firm?	King et al. (2001); Özbağ (2013); Spender and Grant (1996); Hafeez et al. (2002); Prahald and Hamel (1990); Esinehardlt and Santos (2000); Kimishiraj and K Aino (2013)
Potential to access new markets characteristic	Has the firm been able to enter a new product/market recently?	Gokkaya and Ozbag (2015); Srivastava, (2005); Hafeez et al. (2002); Agha et al. (2012); Gilgeous and Parveen, (2001); Hafeez and Essmail (2007).
R&D activities of a firm	Does your company use its R&D budget/activities for innovation?	
Informal R&D activities of a firm	Does your firm have informal R&D activities?	
R&D activtity to enhance a firm's core competence	Does your company use its R&D budget/activities to develop/enhance its core competence?	Coombs (1996); Eisenhardt and Martin (2000); Abell et al. (2008); Cynthia et al. (2012); Hafeez et al. (2002); Schimpf and Binzer (2012); Harris and Trainor (2009); Quelin (2000); Winter (2003); Zollo and Winter (2002)
Innovation activities	Does your firm have collective research activities/budgets for product/process development	OECD (2005); Department of Industry, Innovation, and Science, Government of Australia (2013); Torkkeli and Tuominen (2002)
Exporting activties	What percentage of your sales in the last year were exported?	Gourlay et al. (2005); Love and Mansury (2009); Ganotakis and Love (2011); Saemundsson and Dahlstrand (2005)
Constraints on R&D and innovation activities of a firm	What is the primary constraint on R&D activities and innovation in your company? • finance • size • technological capability • lack of experts	Pisanio (1990); Glande (1996); Santamaria and Surroca (2011); Seddighi (2012); Das and Bing-Sheng (2002); Tether (2002); Basilio and Moreno (2014); European Commission (2013); Zuniga (2010); Edwards and Davison (2008) (2010); Castello et al. (2014); Majeweski (2004); Ahuja (2011); Conte and Vivarelli (2013)
Staff turnover	What is your firm's staff turnover per year?	NELEP (2016b); IIPR (2016); ONS (2016,2017)[1]

[1] NELEP=North East Local Enterprise Partnership. IIPR=Innovative Industrial Properties.ONS= Office of National Statistics.

Table 2
Distribution of firms.

Sector	Number of firms
Manufacturing	209
Engineering	215
Processing	130
Services	546
TOTAL	1,100

Table 3
Breakdown of the responses received.

	Emails sent	Number of Responses	Percentage of responses
Manufacturing	209	71	33.97%
Engineering	215	68	31.63%
Processing	130	42	32.30%
Services	546	149	27.28%
TOTAL	1100	330	30%

the anticipated low response rate in this region. Table 2 present the distribution of the firms selected for this sample.

Table 3 illustrates the breakdown of the responses received.

Empirical results

In order to operationalize this theoretical framework, the first task is to estimate the relationship between a firm's core competence and each one of the aforementioned output/product characteristics. To this end, we have specified a logistic probability function and have followed a Specific to General methodology estimating :(1) a series of bivariate Logit regressions of core competence (Y) on each output/product characteristic *x*, and (2) a general Logit regression model of (Y) on all three characteristics $\times 1$, $\times 2$ and $\times 3$, using a SPSS software Package. (See Supplementary Appendix A for details of the Logit regression model .).

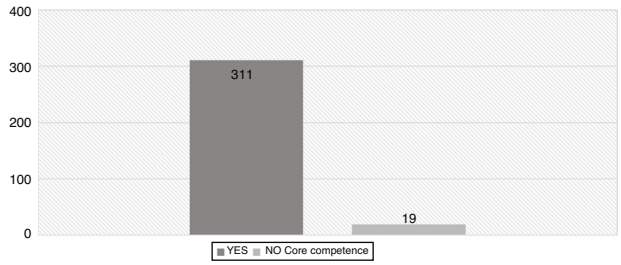

Fig. 5. Number of firms reported having a "core competence" in the sample.

Table S1 (Supplementary Appendix B) Presents the Logit regression results for estimating the conditional probability of a firm's core competence, given the status of each output/product characteristics in turn. The results appear to be statistically significant in all three cases. Taken together, the Wald statistics and the *p*-value of each case, indicate to the statistically significant association between a firm's core competence and each output/product characteristic.. In particular, this is evident from the estimate of the odds ratio, (*Exp (B)*) of each output/product characteristics. Similarly, Table S2 (Supplementary Appendix B), presents estimation results of the multivariate Logit regression model where all three-output/product characteristics are present in the logit equation. The results indicate a statistically significant relationship. It is also interesting to note that, among the three characteristics, the presence of a *firm's potential access to new markets* appears to be the most significant factor contributing to the conditional probability of a firm having a *core competence*. This observation appears to be consistent with recent literature in this area (Danilovic and Leisner, 2007; Özbağ, 2013, p.11; Hafeez et al., 2002 p.30; Bonjour & Micaelli, 2010, p. 5; Fiaz, 2014).

Applying the theoretical framework : the case of North East England's firms

As the identification of a firm's core competence is the lynchpin of the concept (Clark, 2000), several auditing methods and pathways have been modelled in the strategic research domain however, the key attraction of the approach developed in this study is that it offers firms a secure mechanism to identify and develop their core competence and takes the theoretical framework into an operational level.

In order to demonstrate how the above theoretical framework might be operationally employed as a strategic management tool, we have selected 330 firms in our sample data of North- East England firms and based on the Logic regression results, have listed their respective scores (See Table 4). In calculating these scores the following steps were taken:

1 Each firm in our sample was directly asked, via questionnaire, whether they believe they have acore competence. The data suggests that of the 330 firms, 311 of them believe they possess a distinct core competence. (See Fig. 5)
2 All firms were then assessed against the three externally observable output/product characteristics of (1) potential access to a wide variety of markets, (2) difficulty to imitate their products, and (3) generating a value to customers, and mapped to the Logit regression results (see Supplementary Appendix B and C) in order to calculate the points of their core competencies within our scoreboard /classification system (See Supplementary Appendix C)
3 Each firm was assigned its score, and then was included in its corresponding sector
4 The resulting spectrum consists of four segments with distinctive colors, using calculated scores in step 3; each firm was then placed in a core competence –spectrum (See Fig. 4).

Key sample findings

- We have found that firms whose output/products are (1) difficult to imitate, (2) have access to a wide variety of markets and (3) generating a perceived value to customers are highly likely (over 99%) to have a distinct core competence. Furthermore, amongst these output/product characteristics, the ability to access a wide variety of markets is found to be the best indicator of the existence of a firm's core competence in our sample. Furthermore, these firms are, by and large, active in R&D, innovation and exporting activities. These findings appear to support the theoretical foundation of the suggested framework, and thus providing an alternative method, based on the output /product characteristics of a firm, for identification and development of the firm's core competence in practice.
- More specifically, we have found that among the four sectors the majority of processing firms (61.90%) fall into the green spectrum, confirming that they have well-developed distinct core competencies, and are engaged in R&D and innovation and activities (See Table 4). Looking at the data, one can see that, only a few engineering (11.76%) and service firms (7.38%) in our sample of North – East region fall into the green spectrum of this classification system. Also, as can be seen in Table 4, firms that fall in the green spectrum and yellow spectrums appear to be active in exporting. Specifically, those firms that fall in the green spectrum appear to have a higher intensity of exporting activities. For instance, of the 12 firms reported having 50% of exports of their sales, all fall into the green spectrum of this classification system, which further points to a clear linkage between a firm's core competence and exporting activities. This finding is supported by the literature (Gourlay, Seaton, & Suppakitjarak, 2005; Love & Mansury, 2009; Ganotakis & Love, 2011).
- Furthermore, nearly half of both engineering (50%) and service firms (54.36 %) fall into a red segment which appears to have a low probability of developing a core competence and hence low chance of innovation activities within this classification system. This is evident in their exporting activities. For instance, of the 32 engineering firms in the red segment of the spectrum, all do not have any exporting activities at all. Similarly, of the 131 firms with no exports, 81 fall into the red segment of this classification system.
- It is found that a high number of firms in our sample (79 firms) fall into the orange segment of this classification system. Looking at this data, 29.57% of the manufacturing and 22.81% of service firms fall into this category (although, many of them have reported positive responses concerning the presence of a distinct core competence). Instead, they appear to have only potential for developing a core competence within our framework.
- These firms are good candidates for using the proposed framework as a strategic management tool to develop a distinct core competence via improving one /more of the aforementioned output characteristics. For example, they can allocate resources specifically to improve their products access to a broader variety of markets via a targeted R&D activity, within the proposed theoretical framework.
- Despite reporting positive responses concerning presence of a distinct core competence), 36.36% of manufacturing firms; 19.06% of processing firms and 19.11% of engineering firms fall into the yellow segment of this classification system, indicating that their respective core competencies need to be further developed and refined, for example, through improving access to a broader variety of markets via a targeted R&D activities.

Table 4
Classification of firms by sector and Score.

No of firms	*Believed to have core competence*	*Turnover*		*R&D*		*Exports Intensity*		*Score*	
42	*35*	Less than 100000	*1*	Yes	*No*	Nil	*5*	0-4	*2*
		100000- 1 million	*6*			10-25%	*12*	4-6	*6*
		1 million-5million	*11*	*39*	*3*	25-50%	*15*	4-8	*8*
		5 million +	*24*			50%+	*10*	8-10	*26*

Engineering Industry

No of firms	*Believed to have core competence*	*Turnover*		*R&D*		*Exports Intensity*		*Score*	
68	*62*	Less than 100000	*5*	*Yes*	*No*	Nil	*34*	0-4	*34*
		100000- 1 million	*12*			10-25%	*32*	4-6	*13*
		1 million-5million	*2*	*61*	*7*	25-50%	*2*	6-8	*13*
		5 million +	*49*			50%+	*0*	8-10	*8*

Services Industry

No of firms	*Believed to have core competence*	*Turnover*		*R&D*		*Exports Intensity*		*Score*	
149	*139*	Less than 100000	*20*	*Yes*	*No*	Nil	*131*	0-4	*81*
		100000- 1 million	*52*			10-25%	*18*	4-6	*34*
		1 million-5million	*50*	*117*	*32*	25-50%	*0*	6-8	*23*
		5 million +	*27*			50%+	*0*	8-10	*11*

Manufacturing firms

No of firms	*Believed to have core competence*	*Turnover*		*R&D*		*Exports Intensity*		*Score*	
71	68	Less than 100000	2	Yes	No	Nil	20	0-4	7
		100000- 1 million	10			10-25%	44	4-6	21
		1 million-5million	31	67	4	25-50%	5	6-8	26
		5 million +	28			50%+	2	8-10	17

- Based on our sample data, the majority of the firms in this peripheral region appear to fall into either the yellow or the orange segments of the above core-competence spectrum with the vast majority of them (57.6%, 190 firms) do not have access to a wide variety of markets.
- Looking at some broader issues arising from these findings, the data collected (Fig. 6) further exposes the incapability of firms in North- East England to fully develop their core competencies due to various constraints, including finance, size, technological capabilities, and brain drain. Specifically, nearly half of the firms in this sample (157 firms, 47.57%) considered the lack of financial resources as the key constraint for engaging in sustainable innovation activities. These findings seem consistent with the existing literature confirming the linkage between core competence, outpu/productt characteristics, innovation, and exporting (Love et al., 2015; Ljingquist, 2008; Bonjour & Micaelli, 2010).

Following on from this specific demonstration, it is evident that the classification system outlined above (Fig. 4 and Table 4) could provide a practical strategic management tool for regional policy-makers for allocating scarce financial resources to help firms to create and refine distintcore competencies in peripheral regions. In this sense, this practical tool provides a significant contribution in escalating the vague concept of the firm's core competence to

Constraint	No. of firms affected
Size of firm	55
Finance	157
Technological incapability	87
Lack of experts	68

Staff turnover	
<20%	94
20–50%	228
>50	4

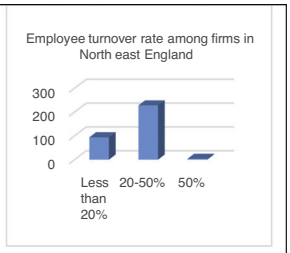

Fig. 6. Types of Constraints on firms for undertaking R&D and innovation activities.

an operational-level reality, which could benefit both firms and policymakers.

For firms, the benefits of employing this strategic -tool are two-folds:

1 This segmentation exercise could be used as a practical self-assessment tool for firms to generate fresh information on their competency levels and areas to improve. For instance, firms in the green segment, with well-established core competencies and a high potential for innovation, could delve into blue ocean strategies (see Kim and Mauborgne, 2005), which are next-level strategies to earn untapped competitive advantage. Firms allocated to the orange segment have the potential to have distint core competencies but need serious attention and further focus to develop these via R&D activities to improve key characteristics of their output/products. Finally, firms in the red segment need critical attention; otherwise, they will be gradually run out of business
2 The scoreboard gives firms a clear indication of their core competence status and their grade. Besides, it indicates the direction of the firm's innovation and long-term strategy and competitiveness.

Furthermore, for regional policymakers, this empirical framework offers an indication of the most innovative and competitive firms in their domain. As a result, policymakers could employ this tool to examine the conditions, competency, and exporting levels of firms in their region. Also, the scorecard generated by the suggested theoretical framework could be further utilized to categorize firms by their grade/level of core competence for financial assistance and a clustering exercise to help regional growth.

A summary and conclusion

Core competence of a firm and its development over time play a crucial role in a firm's innovation and exporting activities ensuring a firm's survival and sustained growth over time. An initial step in an innovation process is to establish whether a distinct core competence potentially exists in order to further develop and enhance it over time. This study was motivated by the need for a strategic management tool for this purpose. To this end, we developed a framework for establishing whether a firm is likely to have a core competence, given a firm's observable output/product characteristics. An essential component of this framework is a classification system, which acts as a strategic management tool for innovation and growth at a firm level. Within this theoretical framework, a firm/organization can strategically allocate internal resources to ensure development and refinement of its core competence via improvement and enhancement of key characteristics of its output/products. Furthermore, it is the externally observable characteristics of what a firm produces, rather than its internal functions that establishes whether a distinct core competence potentially exists, in order to operationalize it for R&D and innovation activities. In this regard this study provides an alternative theoretical and empirical framework for operationalization of the concept of a firm's core competence for innovation in practice.

To demonstrate how this framework might be used in practice we applied it to a sample of 330 North East England firms. Via this application, the theoretical framework was shown to perform well, providing an alternative strategic management tool and a classification system for innovation management in practice.

It is evident from our empirical results that companies operating in the North East England, by and large, have not been able to fully develop distinct core competencies that are needed for innovation and exporting activities. Furthermore, they appear to face severe financial and technological constraints preventing them from remedying this situation via a sustained R&D activity. These findings are consistent with the recent reports of NELP, which illuminates the low productivity of this region and lack of an effective innovation system (NELEP, 2018, 2017).

North East region is lagging behind other key regions of the UK in innovation, R&D, and exporting activities and it would thus benefit from the implementation of a targeted regional policy designed to help firms in these activities. This study provides a practical strategic - management tool for firms, as well as, for regional policymakers for this purpose.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.jik.2019.12.005.

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