GETTING THE TAIL TO WAG - DEVELOPING INNOVATION CAPABILITY IN SMES

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ABSTRACT

This paper reviews the concept of absorptive capacity and its relationship to innovation management capability. It explores four key questions concerning definition, dimensions, distribution and development of AC and presents a model framework for examining policy interventions aimed at enhancing it. 'Broadcast', 'agent assisted' and 'peer-assisted' modes are discussed with reference to examples drawn from case study and survey research across several sectors.

***Key words**: Absorptive capacity; innovation management; SMEs*

1 INTRODUCTION

Whether it is changing an organisation's offering (product or service) or the processes through which they create and deliver that offering, innovation relies on knowledge (Tidd, Bessant et al. 2005). This places emphasis on the learning processes involved in acquiring and using new knowledge – the *capability* to learn. Much recent discussion has explored this topic under the label *'absorptive capacity'* which Cohen and Levinthal described as *'the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends '* and saw it as *'largely a function of the firm's level of prior related knowledge'*. (Cohen and Levinthal 1990) It is an important construct because it shifts our attention from the 'supply' side of knowledge *production* to the 'demand' side where the innovation issue is how well firms are equipped to search out, select and implement knowledge.

Discussion of firm learning forms the basis of a number of studies. (Arrow 1962; March 1991; Simon and March 1992) and in the area of innovation studies the ideas behind 'technological learning' – the processes whereby firms acquire and use new technological knowledge and the underlying organizational and managerial process which are involved – have been extensively explored. (Bell and Pavitt 1993; Freeman and Soete 1997; Kim 1997; Figuereido 2001) The concept has important implications in innovation research and practice; at enterprise level it can help understand the relevant managerial and organizational skills and processes underpinning effective innovation management (Tidd and Bessant 2009). And for a variety of 'policy agents' (those external agents concerned

with improving the take up of new knowledge, the rapid adoption and deployment of new ideas and the building of strong and capable firm level management) it offers the possibility of developing more effective policies.

This paper explores AC and its links with innovation and, drawing on both case and longitudinal studies, makes suggestions for the development of policy to support capability development in innovation management.

2 THE CONTENT OF ABSORPTIVE CAPACITY

Cohen and Levinthal's original work was based on exploring the premise that firms might incur substantial long-run costs for learning a new 'stock' of information and that R&D needed to be viewed as an investment in today and tomorrow's technology (Cohen and Levinthal 1990). Research by Zahra and George (2002) suggested that several different processes were involved – rather than simple absorption of new knowledge there were discrete activities linked to search, acquisition, assimilation and exploitation. Making a distinction between what they termed 'potential' and 'realised' AC helps explain why some firms are unable leverage and exploit external information. Their view of AC as a dynamic organisational capability spawned extensive discussion and application – but also problems of definitional and conceptual clarity, highlighted by Lane, Koka et al (2006). A key theme which does persist is the notion of a complex interaction of processes around identification and acquisition of relevant knowledge, and the ability to apply that knowledge to commercial ends. For example, Todorova and Durisin (2007) suggest that *'transformation'* should be regarded not as a consequence but as an alternative process to '*assimilation'* suggesting a more complex relationship between the components of absorptive capacity.

3 MEASURING ABSORPTIVE CAPACITY

In order to make use of the AC construct we need to explore ways in which it can be dimensionalised and measured. Early studies made use of a variety of approaches – for example, Cohen and Levinthal's work was based on input/output measures of R&D whilst Jansen *et al.* (2005) use data from European multi unit financial services firms in order to test their hypotheses surrounding organisational antecedents such as participation in decision making, job rotation, routinisation, formalisation and socialisation techniques (Jansen and Van den Bosch 2005). Schmidt's research , based on the European Community Innovation Survey, concentrates on the *outputs* of absorptive capacity and creates three dependent variables representing intra industry absorptive capacity, inter industry absorptive capacity and scientific absorptive capacity (Schmidt 2005).

Within innovation studies there is a long-established strand of work concerned with identifying what firms need to learn to establish effective routines for search, selection and implementation. These have been used to develop various kinds of diagnostic instruments – innovation audits – to enable firms to assess their current capability and facilitate organizational development. For example, in the 1980s the UK National Economic Development Office developed an 'innovation management tool kit' which was adapted for use as part of a European programme aimed at developing better innovation management amongst SMEs. Another framework, originally developed at

London Business School, was promoted by the UK Department of Trade and Industry (Chiesa, Coughlan et al. 1996) and led to the development of a series of frameworks including the' Living innovation' model which was jointly promoted with the Design Council (Design_Council 2002). Francis offers an overview of a number of these.(Francis 2001) Other frameworks have been developed which cover particular aspects of innovation management, such as continuous improvement and product development. (Bessant and Caffyn 1997; Oliver and Blakeborough 1997) With the increasing use of the Internet have come a number of sites which offer interactive frameworks for assessing innovation management performance as a first step towards organization development.[1]

Much of this work has close parallels with the themes of absorptive capacity. For example Bell's (2003) competency levels model involves a framework in which organisations pass from the point of *'acquiring and assimilating imported technologies'*, through phases of *'technology deepening and upgrading'* and *'closing in on the international technological frontier'* to reach a stage where the organisation is *'generating core advances at international frontiers'*. This describes a process of moving from low or zero capability, developing minimal capability up to a level of competence, ultimately to become (high) performers. In similar fashion Arnold and Thuriaux (1998) describe four degrees of a firm's levels of knowledge relating to technological capability. These degrees of 'mastery' are conceived in terms of boxes which progress from opaque to transparent and closed to open in a series of boxes, starting with a closed 'black box' through stages of 'grey' and 'white' box to an 'unboxed' state at which point a firm is generally able to develop significantly new variants or innovations. Progression through Arnold and Thuriaux's levels, moving from an awareness of the problem (not of the solution) through three succeeding levels of understanding and action roughly correspond to the assimilation and transformation levels of Zahra and George (2002).

In an earlier paper (based on work with the World Bank) we attempted to link knowledge about key abilities in technological innovation to states of development of technological capability which enable a firm to choose and use technology to create strategic competitive advantage.(Rush, Bessant et al. 2007) Studies which particularly influenced our thinking in developing the tool included developed country studies on technology development (e.g. Ansoff and Stewart (1967), Teece and Pisano (1994), Utterback and Abernathy (1975), Kay (1993), Hamel and Prahalad (1994), Tidd et al (1997)) and other studies forcusing on developing countries (e.g. Kim (1997), Choi (1994), Fransman and King (1984), Gerstenfeld and Wortzel (1997), Dahlman et al (1985) (Saad 1999; Figuereido 2001). The tool also builds directly upon previous World Bank sponsored research (Arnold et al, 2000).

4 DISTRIBUTION OF AC

Absorptive capacity is clearly not evenly distributed across a population. For different reasons firms may find difficulties in growing through acquiring and using new

knowledge. Some may simply be unaware of the need to change and also lack the capability to manage such change. These enterprises differ from those which recognise in some strategic way the need to change, to acquire and use new knowledge but lack the capability to target their search or to assimilate and make effective use of new knowledge once identified. Others may be clear what they need but lack capability in finding and acquiring it. And others may have well-developed routines for dealing with all of these issues and represent resources on which less experienced firms might draw – as is the case with some major supply chains focused around a core central player. (Hobday, Rush et al. 2005) Table 1 indicates a crude typology assuming different states of development of a capability to organise and manage the innovation process in its entirety, from search through selection to effective implementation of new knowledge. Such capability – absorptive capacity – involves the presence and embedding of a high order set of learning routines.

Table 1: Archetypes in development of absorptive capacity

State	*Key characteristics*	*Development needs*
Type A – 'unaware/passive'	Do not realise or recognise the need for technological change and also do not know where or what they might improve, or how to go about the process of technology upgrading. As such, they are highly vulnerable to competitive forces and even if they do make changes they may waste scarce resources by targeting the wrong kinds of improvement.	Support for recognising the need for change (the 'wake-up call'); developing a strategic framework for manufacturing and other activities; identifying relevant and appropriate changes; and acquiring and implementing necessary technologies. Enterprises in this category may also require assistance in sustaining the process of change over the long-term.
Type B – 'reactive'	These enterprises recognise the need for change but are unclear about how to go about the process in the most effective fashion. Because their internal resources are limited - and they often lack key skills and experience in technology – they tend to react to technological threats and possibilities, but are unable to shape and exploit events to their advantage. Their external networks are usually poorly developed. Most technological know-how comes from their suppliers and from observing the behaviour of other firms in their sector. They may well be 'keeping up' with other firms which may have similar weaknesses and limitations in technological capability. Typically, this group treats symptoms rather than root causes of problems.	The needs of this group centre first on the development of a strategic framework for technological change, so that key priority areas can be addressed. Allied to this, are needs in searching more widely for solutions, in exploring new concepts (for example changing production layout rather than simply acquiring new machinery), and in acquiring and implementing new product and process capabilities. In the longer-term, such firms could be expected to develop an internal capability for strategic upgrading and require less and less support.
Type C – 'strategic'	Enterprises here have a well-developed sense of the need for technological change and have good implementation capability. They take a strategic approach to innovation and have a	The needs of this group are essentially around providing complementary support to internal capabilities and challenging existing

	clear idea of priorities. They benefit from an explicit framework for managing search, acquisition, implementation and improvement of technology. However, they tend to lack the capabilities to re-define markets through new technology, or to create new market opportunities. They tend to compete within the boundaries of an existing industry and may become 'trapped' in a mature or slow growth sector, despite having exploited technology efficiently within the boundaries of the industry. Sometimes, they are limited in knowing where and how to acquire new technologies beyond the boundaries of their traditional business.	business models. Improving access to specialist technical and marketing expertise, enabling access to new networks of technology providers (for example, overseas sources) can assist these firms to think 'outside' of the industrial box they find themselves in, should the need arise. Such firms may also benefit from occasional, project-based support from consultancy companies or from specialist research and technology organisations, locally or internationally. These firms may benefit from improved access to graduates and from linking up with universities which offer new ideas, access to advanced technology and new skills.
Type D – 'creative'	*Type D* firms have well-developed technological capabilities and are able to help define the international technology frontier. In many areas, they take a creative and pro-active approach to exploiting technology for competitive advantage. They are at ease with modern strategic frameworks for innovation and take it upon themselves to 're-write' the rules of the competitive game with respect to technology, markets and organisation. Strong internal resources are coupled with a high degree of absorptive capacity which can enable diversification into other sectors, where their own skills and capabilities bring new advantages and re-define the ways in which firms traditionally compete, or wish to compete. Their technology and market networks are extensive so that they are kept informed about new technological opportunities and remain in touch with suppliers of equipment and ideas.	The needs of this group are mainly around complementing existing internal capabilities with outside sources, assessing risks and uncertainties and sustaining their position as a 'rule breaker'. They tend to be open companies which collaborate and learn from partners in the external environment and invest in developing new technologies and resources, for example in leading universities around the world. From time to time projects emerge with threaten to disrupt their existing businesses and they are often in a strong position to convert such threats into new market opportunities. Such firms may need to develop new contacts with specialist groups (domestic and overseas) in order to resolve complex technical problems and generate new opportunities.

5 DEVELOPING ABSORPTIVE CAPACITY

Reviewing the literature on why and when firms take in external knowledge suggests that this is not a function of firm size or age (Phelps, Adams et al. 2007). It appears instead that the process is more one of transitions via crisis – turning points. Some firms do not

make the transition, others learn up to a limited level; additionally the ability to move forwards depends on the past. This suggests that developing absorptive capacity requires a second order learning process, one geared around building capability through successful navigation of these crisis points. The analogy with human organisms is helpful here – as firms develop maturity they become capable of managing an increasingly sophisticated set of external challenges (Argyris and Schon 1970; Senge 1990). Arguably external intervention of some kind might help the development of capability, particularly at lower levels, and it is here that policy agents may play a role. The question is *how* they might make such interventions to effect such acceleration of firm-level learning towards higher levels of absorptive capacity?

6 EMPIRICAL WORK ON DEVELOPMENT OF AC

In the following section we develop a typology for understanding and exploring this question based on two complementary streams of research:

- a series of case studies of attempts at facilitation and intervention
- a major longitudinal study of over 200 firms in the south east of the UK participating in 'learning networks' (Bessant and Tsekouras 2001) .

In the former the focus of study was a series of interventions by policy agents acting at sectoral, regional and supply chain levels in several countries. Fifty interviews were carried out with 'innovation counsellors', firms and policy agents and a number of detailed case studies of several 'learning networks' were produced during a five year period (Bessant, Kaplinsky et al. 2003; Bessant, Morris et al. 2003; Morris, Bessant et al. 2006). In the second a pilot programme in the Hastings area led to subsequent establishment of 34 learning networks involving over 200 firms across the South East of the UK. These were studied by a team of researchers over an 18 month period using a combination of interviews, surveys and data collection workshops. In both cases data was collected on dimensions of absorptive capacity and the extent to which this capability changed as a result of different kinds of intervention.

7 A TYPOLOGY FOR INTERVENTION

We can characterise relevant approaches into an emergent typology which moves along a continuum from *laisser faire* - i.e. leave it to the market and do not intervene – through to different modes of intervention (Adams and Bessant 2008). *'Broadcast'* mode refers to providing information in various forms to help improve awareness of firms about the need to change and to facilitate more effective search. Whilst information may be made available in 'passive' form – where the policy agent acts as a 'signpost' or 'library', there is often a deliberate promotional aspect – for example, various forms of awareness campaigns which are designed to challenge the firms and cause them to question whether they need to take new knowledge on board.

For example, early UK government policies designed to promote innovation were often simply letters from relevant ministries but there has been a massive increase in the range and sophistication of such mechanisms during the past 25 years. The 'Managing in the 90s' programme and its successor 'Fit for the future' made use of public presentations,

road shows, breakfast briefings, television and radio, video, CD and DVD, and extensive web presence to promote innovation to a manufacturing audience (Rush, Bessant et al. 2004). In terms of diffusion theory we can see the potential contribution of such approaches at an early stage on the diffusion curve. Economic rationality is a strong force at this point and different mechanisms within the broadcast mode have the effect of taking this message out to potential adopters who can then see the relative advantage and adopt. Whilst such a model works well for innovations which are easily 'packaged' (like industrial robots) it may be less successful when a high degree of configuration and adaptation is required.

Broadcast mechanisms have evolved to include not only information but an increasing component of 'storytelling', often in the words and experience of early users. For example one of the more successful schemes within the 'Fit for the Future' panoply was 'Inside UK Enterprise' – a scheme of factory visits which allowed potential adopters to visit and see for themselves a wide range of innovations actually working in a range of different size and sectoral contexts. Similarly many of the road shows increasingly featured presentations from early adopters and there was a growing library of such case studies on the website. Arguably the contribution of such mechanisms is towards isomorphic pressures around the economic rationality argument.

'Agent assisted' modes of intervention are designed to deal with the gap between awareness and search – and the subsequent assimilation and exploitation aspects of absorptive capacity development. As a result of effective broadcast mechanisms firms may have a general awareness of the potential of the innovation on offer but do not see its relevance or applicability to them. In terms of diffusion theory there is little *perceived* relative advantage, there may be high perceived complexity, there may be major concerns about compatibility and slow adopters may be unconvinced or unwilling to undertake trials. Under such conditions there appears to be a role for some form of intervention based on individuals helping potential adopters explore and experiment before committing themselves to a decision. (Bessant and Rush, 1995; 2000). Consultants, 'innovation counsellors' and others act as intermediaries, helping decision-makers within the firm explore, articulate and make their adoption decisions. The effectiveness of these approaches depends to some extent on social system variables such as the perception of the 'agent' as someone who is credible, understands the context and can offer challenging and reliable input to the decision process. *'People like us'* are preferred to those from government, academe or large, high technology businesses who may be perceived as coming from different contexts.

Innovation agents of this kind can also help firms position the potential innovation in a wider strategic context (in the process articulating the economic rationality argument) – this was the philosophy behind UK schemes like 'Making IT Fit' which helped less experienced firms develop a manufacturing strategy within which they could see the relevance of innovations and the arguments for their deployment. They can provide a window on the experience of others in similar circumstances – a focussed set of case studies and experiences which help deal with observability and compatibility concerns and which generate a degree of isomorphic pressure. And they can help facilitate a degree of 'safe' experimentation and configuration around a generic idea. Much of the

work of the UK's Manufacturing Advisory Service operates on this basis with trained consultants offering a 'hand-holding' introduction into implementing new manufacturing techniques.

Agent-assist mechanisms have become an increasingly important element in many national and regional innovation policy frameworks and have had demonstrable influence in capability development and in accelerating take-up of new techniques. Examples can also be found in supply chains where there is growing use of firm-to-firm support via secondment of personnel – the 'guest engineer' approach. And several countries make use of an element of innovation policy – in the UK known as 'Knowledge Transfer Partnerships' – in which bridging between universities and firms is made via people who work in the firm transferring key knowledge from the partner university. This 'human bridge' enables a rich and two-way flow of knowledge between the partners and has been very positively evaluated on a number of occasions.

Understanding the potential value in working within the social system underpins a third approach, which we term *'peer-assisted'*, where emphasis is placed on firms learning from and with each other. Such mechanisms are based on the principle that adoption of new ideas can be accelerated by the engagement of 'people like us' alongside potential adopters. This embraces Rogers' notion of 'homophily' in which the communication of innovation is enhanced by its being carried out by people who are perceived as similar along key dimensions such as social status, experience, education, etc.(Rogers 1995) As with earlier diffusion studies (such as those on the adoption of hybrid corn varieties in US agriculture (Griliches (1957); Ryan and Gross (1943)) the potential of people in a similar context to act as catalysts and accelerators of adoption is significant.

This has relevance for several dimensions of the diffusion problem – for example, peer assist mechanisms can help convert a generic set of attributes into something of specific relevance and interest for the potential adopting group. Relative advantage perceptions can be shaped, issues and concerns about compatibility can be addressed, observability (the 'seeing is believing' effect) can be enhanced if the subjects being observed are 'people like us'. This fits with the institutional theory perspective in which isomorphic pressures become increasingly significant in later stages of the diffusion curve; peer assist mechanisms define and mobilise the population of peers who can create these pressures.

Peer assist mechanisms typically make use of firm-to-firm interactions to accelerate diffusion. One example is in the field of supply chain learning in which key players in an extended supply chain or network organize a process of innovation across the system, deploying various peer assist mechanisms. (Bessant, Kaplinsky et al., 2003; DTI/CBI, 2001). Such efforts are usually focused on upgrading key performance dimensions – such as quality, cost and delivery – which are susceptible to improvement through the adoption and implementation of new technologies and techniques. Studies of facilitated learning/capability development behaviour in supply chains suggest considerable potential – one of the most notable examples being the case of the *kyoryokukai* (supplier associations) of Japanese manufacturers in the second half of the twentieth century. (Cusumano 1985; Hines 1994; Dyer and Nobeoka 2000) Hines reports on other examples of supplier associations (including those in the UK), which have contributed to sustainable growth and development in a number of sectors particularly engineering and

automotive. (Hines, Cousins et al. 1999) and Lamming (1993: 206) identifies such learning as a key feature of 'lean supply'. Marsh and Shaw describe collaborative learning experiences in the wine industry including elements of SCL, whilst the AFFA study reports on other experiences in the agricultural and food sector in Australia.(AFFA 1998; Marsh and Shaw 2000). Case studies of SCL in the Dutch and UK food industries, the construction sector and aerospace provide further examples of different modes of SCL organisation. (Fearne and Hughes 1999; AFFA 2000; Dent 2001). Humhprey *et. al*. describe their emergence in a developing country context (India) (Humphrey, Kaplinsky et al. 1998). Importantly these are not simply the by-products of network or supply chain activities; as one report comments, *'learning is not a natural feature of business networks. It is unlikely to thrive unless it is part of the emergent new models for inter-company collaboration which stress trust, co-operation and mutual dependence'* (DTI 2000; DTI and Office 2000).

A major UK example was the 'Industry Forum' (IF) which originated as a sector-level activity in the automotive components field. Co-ordinated by the Society of Motor Manufacturers and Traders and backed by the UK Department of Trade and Industry, IF developed an approach to facilitating learning about and adoption of new manufacturing approaches involving core metrics of performance (cost, quality and delivery). Its success in the automotive sector led to more widespread promotion in 12 other sectors. (Bateman and David, 2002; Chambers, 1996; DTI, 2001).

IF operates on the basis of multiple mechanisms to engage and enable adoption of new ideas. Typically there is a core framework which involves some form of 'benchmarking' which creates a motivation for change in order to close performance gaps in key areas like cost, quality and delivery. Although such data is widely available outside of peer assist schemes, we would argue that it is the exposure to such benchmarking in the company of peers which creates a strong isomorphic pressure for change which underpins the adoption decision. Enabling learning and configuration involves demonstrations and exposure to other's experience together with a phase of facilitated learning by doing which enables local configuration to suit particular contexts and which deals with many of the perceived compatibility questions raised by transfer of new knowledge. These mechanisms include a high level of people-based support, for example through the loan of engineers and other experienced personnel as transfer agents.

There is growing evidence to support the use of peer assist modes of intervention. For example, in South Africa the domestic automotive components sector faced significant performance gaps as it moved into the post-apartheid era. Catching up to the 'world class' frontier became an urgent priority and one approach was the formation of a series of 'benchmarking clubs' in key regions where the sector was a significant element in the local economy – around Durban, along the Eastern Cape seaboard and in the areas between Pretoria and Johannesburg. These clubs operated in similar fashion to IF, using a mixture of benchmarking to develop shared motivation for change allied to extensive inter-firm support for experimenting with and learning about new manufacturing approaches and particularly how they could be adapted and configured to suit very different educational, social and cultural conditions.

8 THE PROFITNET CASE

It is worth looking in detail at an example of peer-assisted networking and its potential for developing absorptive capacity. Concern in the UK for improving linkages between small and medium-sized enterprises (SMEs) and sources of knowledge such as universities and colleges led to a pilot programme based in the Hastings area which used a 'learning network' approach. The 'Profit through Networks (ProfitNet)' programme brought together managers (often owners) of SMEs to explore issues around business growth and to develop linkages and support for dealing with these issues. A strong 'action learning' approach meant that the participants became resources for each other – but in addition they became aware of additional and external options and how to access and utilise them. The pilot proved so successful that a major initiative was commissioned involving 174 enterprises across the South East UK, grouped together in 14 learning networks. Some were organised on regional basis, some on common interests – for example, those in the 'creative industries'. The format was a mixture of regular networking meetings at which, in addition to direct interchange and leanrning amongst participants, formal inputs on themes like marketing, business planning, support for organizational development and general business skills were made. Over the two year period of operation the behaviour and characteristics of individual firms and the networks were monitored by a research team to enable the capture and codification of learning about this approach to capability development within firms.

The impact was significant – in addition to a high degree of reported satisfaction with the process there were clear changes in the business performance. On average, turnover increased by 13%, gross profit by 19% employment by 5.3%. For our purposes it is interesting to look at the impact on innovation; during the period the number of new products rose by78% and the number of new services increased by 92% and there were 24 new business start-ups. In addition members undertook improvements to internal operations, human resources and managing people and improvements to administration and other back office activities. Importantly members felt that these had emerged as a result of improved understanding and skill development in areas like networking, project management and business strategy – essentially key components of absorptive capacity. Of particular relevance was the increase in external networking and knowledge acquisition – for example, nearly half (41%) reported the use of business advice exchange across the network whilst 24% had entered into formal joint ventures with other group members. In terms of links with the local universities 6 of 11 Knowledge Transfer Partnerships launched during the 2007/8 period were directly associated with Profitnet whilst 45% of ProfitNet members indicated that they have formally collaborated with a university.

9 CONCLUSIONS

In terms of improving the ways in which knowledge is translated into value in the form of product, process and service innovation it is clear that the concept of absorptive capacity is important. The 'wealth from knowledge' problem is not simply one which requires more investment on the supply side of knowledge creation – there is also much to be gained from working to enhance the demand side. By increasing the level of absorptive capacity firms will, arguably, draw in, assimilate and deploy new knowledge more effectively.

But working with this construct requires that we move it from a nice theoretical point about R&D spending to one which has relevance for the majority of SME firms which make up the economy. We need to look more closely at the dimensions of AC and at how it can be measured and the results used to focus development attention by policy agents. This perspective should not simply tell us which firms have more or less AC but which aspects of AC are poorly developed – e.g. search? acquire? assimilate? deploy? – and thus where to focus organizational development interventions. Beyond this we need to explore the different modes and mechanisms through which such interventions towards capacity building can take place. We have suggested that there is a broad range and that for weaker firms emphasis may usefully be placed on experiments with agent and peer-assisted modes.

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