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Abstract

Organisations have to learn from their environment, any KM effort that does not incorporate this will be partial. Research into the Australian wine industry shows that firms absorb and utilise the world's leading research, practice and techniques to create strategic competitive advantage. They have strong absorptive capacity, but use organisations and mechanisms outside of themselves to assist this. Extended absorptive capacity is where the organisation is able to access knowledge packaged in a useable form without having to understand or absorb this knowledge itself. System absorptive capacity, a concept developed from this research, is where firms access knowledge in a useable form through a system of innovation and competence development. The Australian wine industry has strong whole of industry institutions and actors that result in Australian wine companies being able to access and use knowledge that they themselves are not able to with their internal knowledge and skills alone.

Keywords: *Absorptive Capacity, Innovation Systems, Competence Development Systems, Knowledge Management, Wine, Learning, Knowledge, Networks, Strategy*

Introduction

All organisations, including firms, are embedded in an environment and systems of knowledge creation and diffusion, and all organisations produce only a fraction of the knowledge they need to survive. Thus the systems that lead to knowledge being transferred in a useable form to firms are crucial underpinnings of their commercial success. Most previous studies look either inside the firm, or at the surrounding system, whereas this work contributes theory and a framework to bridge this gap. This work uses the framework of Competence Development Systems (CDS) and its associated links to the evolutionary theory of the firm and innovation systems, as developed in the author's PhD thesis, to explain how the wine industry in Australia gains and utilises knowledge; that is how firms gain competence in the production of wine, in delivering value-offerings for customers and thus in competition.

Firms' internal knowledge generation capabilities and absorptive capacity have been well studied, but how their competences are developed through external sources, the CDS, has been less studied. In order to explore the CDS, the author proposes two lenses; system absorptive capacity and extended absorptive capacity. These two concepts are extensions of the classic absorptive capacity concept developed by Cohen and Levinthal (1990, p 128), defined as 'the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends'. The key issues that affect absorptive capacity in a firm are related prior knowledge and diversity of background within the firm, thus leading to a firm's absorptive capacity being history and path dependent. Extended absorptive capacity is defined as where firms seek out or have new information brought to them in such a way that they can recognise its value and are able to utilise it for commercial ends, without having to absorb or understand it. System absorptive capacity is where the system outside any particular firm is able to recognise the value of new, relevant information, assimilate it, and provide it to firms such that the firms can apply it to commercial ends. The Australian wine industry is underpinned by a very strong and coordinated system absorptive capacity, but extended absorptive capacity is only really significant in smaller firms.

The paper is structured as follows; section 2 explores the theory and the frameworks of both extended and system absorptive capacity, and contributes a framework for analysing absorptive capacity. Section 3 discusses the research findings, including methodology and extended and system absorptive capacity within the Australian wine industry. Section 4 is the discussion and conclusion.

Theory and framework

Most firms produce products that are well understood by their customers. The customers purchase based on some judgement of value as compared to cost, where value and cost are both economic and perceived. The perceived value and inter-firm competition lead to the price paid; firms compete on the basis of providing value to the customer, they are viable only if the price is higher than the cost of production. Thus increasing value to the customer or improving productivity are the routes to success.

The ability to produce value for the customer is the manifestation of competence. Competence as a firm based concept emerged in the late 1980s with the core competence of the corporation (Prahalad and Hamel 1990) being considered the underpinning of success. Competence is defined here as the ability to perform a task or holistic set of tasks that provide some competitive advantage or faculty to the firm, more fully discussed by Sanchez (2004). This competitive advantage is based around the value offered by the firm's product offering in comparison to the competing product offerings, and is always evolving and changing (Nelson and Winter 1982; Langlois and Robertson 1995). Thus understanding how competence is developed, in an evolutionary sense, is a key to understanding the dynamics of how firms can best obtain and use information and knowledge to advance themselves.

The ability to absorb and use for commercial purposes information and knowledge that is external to the firm is thus a significant factor in how a firm develops its competence and thus its competitiveness. In this paper the internal workings of the firm will not be looked at, the focus is on two alternative modes of absorptive capacity, one external, having a fully developed capability brought into the firm; the other, system, where the system searches for, validates, repackages and transfers new and relevant information to firms.

Competence development systems have a starting point in the innovation systems literature (Lundvall 1992; Nelson 1993; Edquist 1997), particularly the sectoral innovation systems (Malerba 2002), distributed innovation systems (Andersen and Miles 1999), and technological systems (Carlsson and Stankiewicz 1991). However the innovation system literature is weak in linking systems of innovation to firms and their competitive offerings. This paper aims to contribute through filling some of that hole.

Extended absorptive capacity

Extended absorptive capacity is defined as where firms seek out or have new information brought to them in such a way that they can recognise its value and are able to utilise it for commercial ends, without having to absorb or understand it. That firms often do not fully understand aspects of what they are doing or have others perform parts of the creation of value for their products is often not acknowledged in the literature. Outsourcing is simply one common example of where this occurs. The actors in extended absorptive capacity are often consultants and firms offering pre-packaged solutions to problems and/or enhancements to the firm's product offering, which when consumed leads to the value-offering.

In many cases, aspects of the firm's product offering, what it actually produces for the market, is created by other organisations. This aspect of extended absorptive capacity is where firms use other actors to produce some part of the firm's product offering, such as entrepreneurs getting contract wineries to make the wine that they sell. Many firms do not produce their commercial products entirely internally, they use external actors to perform key parts of their production process.

System absorptive capacity

System absorptive capacity is where the system outside any particular firm finds and creates new information and knowledge, validates it for use then *transfers* it into firms and supports their use of it for commercial ends. System absorptive capacity occurs through the set of actors and institutions that support the search for new knowledge relevant to the particular competence/s, then validate and repackage the information in a form that is useable by the firms in the CDS, and then those institutions and organisations transfer and support this new information into firms so that they can use it to productive ends.

To clarify the difference between these concepts, extended absorptive capacity is where some external agent packages information and knowledge to provide the firm with an aspect of their product offering, system absorptive capacity is where the information is found and provided by the system to the firm but the firm has to repackage it for use in product offerings itself.

The players in this system level concept are actors whose function is to search for new knowledge and information, to validate it and then digest and turn it into a form that is understandable by practitioners and firms, then support it in being passed onto firms for use in product offerings. Such players as universities, public research agencies, the Vocational Education and Training (VET) system, industry bodies and the labour market organisations and institutions, as well as firms such as suppliers, consultants and other similar players are the core actors in system absorptive capacity. The firms that actually produce the value-offering are on the receiving end of this concept.

An important part of the CDS framework is institutions, which are a collective result of social interaction and are the guides for social systems. Institutions are defined by Edquist and Johnson (1997):

Institutions are sets of common habits, routines, established practices, rules, or laws that regulate the relations and interactions between individuals and groups (Emphasis in original).

Institutions are important because they guide the evolution of social systems, they disallow certain actions and encourage others. They provide a guide for how to do certain things and how to interpret the world. Institutions can be hard or soft (Edquist and Johnson 1997), that is enforceable and explicit such as the law, or guiding and not enforceable such as table manners. Hodgson (2000) views institutions as being constructed by individuals, and the individual as being socially and institutionally constructed. Consequently institutions are the glue that hold the system together.

Four phases of absorptive capacity

For research and analytical purposes, the author has broken absorptive capacity into four phases and the necessary actions and players for each of the phases for both systems and extended absorptive capacity is discussed in the research results. The phases are: search; validation; absorption; and use, as explained further below;

1. Search is the phase of becoming aware of new information that is relevant in some way to the competence and the value creation that occurs through it.
2. Validation is where the information is validated as to its usefulness. That is not to say that the objective truth is the basis of validity, validity is a cognitive act where some rule is invoked that the information is valid against a certain model of the world (Tamborini 1997). Validation of information and the models that underpin our knowledge of the world is a cognitive construction of reality, which we as humans socially and individually evoke to create meaning for all of our actions (ibid).
3. Absorption is where the knowledge is taken into the firm and made useful for productive purposes.
4. Use is where the knowledge is used in the competence, and the value-offering is therefore changed or enhanced in some way.

Search, validation, absorption and use of knowledge in the Australian wine industry will be discussed in the following section, using both the lenses of extended and systems absorptive capacity.

Research method and results

Research method

This research was done in 2003/4 as a case study (Yin 1994) of the Australian wine industry, with triangulation of results (Miles and Huberman 1994; Yin 1994) obtained using multiple data collection methods (Denscombe 2001), primarily 64 interviews (Mathers et al. 1998), but with archival and statistical data used as well. Analysis is primarily qualitative (Glaser and Strauss 1967; Miles and Huberman 1994) using the NVivo program (Richards 2000; Bazeley 2003) for coding and analysis of the results. Informants were viticulturalists, winemakers, managers, public servants, researchers, educators, industry association people and suppliers.

Overview of the Australian wine industry

The Australian wine industry has a history of approximately 200 years (Beeston 2001; Faith 2002; Gent 2003), during which it has evolved from a small scale and technically backward producer to now being one of the world's most important players (Anderson 2003). In the last 20 years Australia has moved from being a net importer of wine to having over half of all wine produced exported, in particular moving into the premium bottled wine segment of the market (Anderson and Norman 2001). This spectacular export success shows the rapid increase in competence in the Australian wine industry, both in its own right and in comparison to other nations.

The wine industry can be broken into two knowledge areas; viticulture, or grape growing, and winemaking itself. Viticulture is an agricultural knowledge base with its own specialised equipment and techniques, whereas winemaking has a microbiological and process engineering knowledge base, with entirely different technology and techniques to viticulture. The key linkage is that the grapes are the most important input to wine, determining taste and cost more than any other aspect of the wine making process. Sometimes certain features are specific to either viticulture or winemaking, as well as there being a number of system wide aspects.

Production is dominated by a small number of large wine producers, the top four producing about 80% of all wine produced in Australia, and the top twenty firms producing over 90%. These corporations produce about 25% of all grapes, and have been trying to reduce the

financial burden of their vineyards, whilst retaining control over quality and the potential to learn from their vineyards. There are approximately another 1650 wineries producing the last 7 or 8% of production, and about 8,000 independent, that is non-corporate, vineyards.

Extended absorptive capacity in the Australian wine industry

There are several areas where the wine industry exhibits far-reaching extended absorptive capacity, primarily in smaller size firms. But as shown above the smaller players are a minor part of the industry's production.

The main drivers for extended absorptive capacity in the wine industry is the capital intensive nature of many of the resources needed for mechanised viticulture and for winemaking and the knowledge intensive nature of some support services and winemaking. Due to these resource limitations it is mainly the small players who access the extended absorptive capacity of the Australian wine industry.

Both grape growers and winemakers use the services of external laboratories to get testing of various aspects of production done. In particular for the growers this can be important in testing the land that the vines are planted in, the health and nutritional needs of the vines and other specialised analytical needs. Winemakers do use external laboratories for testing of wine, but even small wineries will have key chemical testing equipment.

Grape growers sometimes hire the services of mechanical pickers for their grapes. These pieces of equipment are very expensive and a small grower, unlike a corporation, has not enough need for them to justify their purchase. Private contractors purchase these and then pick the grapes for independent growers, thus giving the grower the competence to pick the grapes with the advantages of mechanised equipment, without having to absorb the cost of the equipment or the knowledge of its use.

The extended absorptive capacity in the skills of a wide range of consultants are sometimes employed to run the vineyard or the winery, and combined with capital investment even to contract production of wine. Time and experience constraints required to learn how to grow grapes and make wine well means that it is sometimes more economical and efficient to utilise outside skills. Formally qualified viticulturalists and winemakers, who have years of experience at growing grapes and/or making wine provide their expertise to other operators to remove the need for the owner of the firm to gain these skills themselves. A wine science degree is three or four years fulltime, plus experience on the job, thus a time commitment of five to ten years to learn the skills that contract winemakers offer on a per bottle cost. Once again this skill utilisation is usually done by the smaller players, as larger firms often have a full-time professional doing this for them. Many small players, who grow their own grapes, have their final product made for them by someone else. This is usually done because of cost, a small winery is in the order of \$1 million according to industry informants, and the time and effort required to become a good winemaker is significant. This example of extended absorptive capacity shows how having the knowledge and capability in-house to produce your value-offering is not absolutely necessary. The competence to produce a value-offering is related to, but not the same as having the knowledge internally to produce the product.

In terms of the four phases of absorptive capacity presented previously an extended absorptive capacity search can be passive or active. The firm can look for those who are able to repackage knowledge to develop the firm's competence, or can be approached by them. For many actors this repackaging of knowledge to be used by others is their business, for example

consultants. The validity of this repackaged information and knowledge typically depends on use and reputation. For example wine shows objectively judge a wine's merits, thus allowing verification of the winemaker's ability; for laboratories, independent bodies certify their competence. The ultimate verification is use of the extended absorptive capacity provider's services to produce part of the product offering. Absorption and use are through actually using the repackaged knowledge in a way that is integrated with the firms operations to produce the product offering. The classic example of this is the contract winemaker, who makes the wine that the firm sells.

System absorptive capacity in the Australian wine industry

A strategically coordinated whole-of-industry system of absorptive capacity exists in the Australian wine industry. There is an array of organisations that are institutionally linked through networks and cultural attitudes, as well as linked into education, research and other systems. This system deliberately coordinates itself to advance the industry, especially through the Strategy 2025 document as discussed below.

There is an array of industry bodies that work in three coordinated tiers: local, state and national. The local associations typically focus on issues of greatest concern to the region, they link with the state and national bodies to access knowledge and learning opportunities, as well as pooling resources to further their region. The state associations deal with state issues, governmental and state institutions. At the national level there is an array of players, ranging from federal government to industry associations. Each aspect of the industry is represented by an organisation, duplication is minimised and there is an array of interlinking committees, boards and other collaborative arrangements. These organisations focus on improving the competence of the industry at producing wine, from planting the vineyard to final sales, to finance, regulations and export facilitation. Thus this collective of industry organisations organises the search, validation and absorption of relevant and productive information, with a holistic focus on improving the Australian wine industry's competence and thus competitiveness.

An important set of actors and institutions for finding and transferring information to industry is through the funding mechanisms for research and the extension of key information to practitioners. The industry has a compulsory levy, set by the industry but administered by the federal Department of Agriculture, Forestry and Fisheries (DAFF), which funds the Australian Wine and Brandy Corporation (AWBC) and the Grape and Wine R&D Corporation (GWRDC). The AWBC acts as the industry regulator, collects and provides analysis on industry statistics and supports exports. The AWBC gives all of the Australian wine industry access to authoritative and industry specific information, including statistics, which allows all players a sophisticated and comprehensive understanding of the industry, specific information on their area of operation, as well as projections that allow well informed decision-making across the industry. The AWBC also administers testing of all export wine, as a proportion of most wines are exported this puts an industry wide and independent benchmark under Australian wine production. This aspect of the industry was emphasised in my research as being very important. It eliminates illegal production methods, ensures wine is of 'merchantable quality', gives feedback to wineries and provides an industry wide statistical database on wine composition.

The GWRDC, also levy funded, funds research and extension in the industry, as well as coordinating the viticulture and wine research and information dissemination system. Through this role it is able to eliminate duplication, balance the portfolio of research, and

strategically target issues of concern. The other funder of research and extension is the Cooperative Research Centre for Viticulture (CRCV), which is the second, seven-year, federally-funded Cooperative Research Centre for the industry. These two organisations fund and coordinate the industry's R&D and information dissemination efforts, in collaboration with the other industry bodies.

The research system itself acts as a system level search capability, creating new knowledge and finding and absorbing relevant information globally. The wine and viticultural sides are very different in structure. On the wine side R&D is focussed on the Australian Wine Research Industry (AWRI), with some universities doing some research, but the AWRI performing the bulk of the wine research in Australia, as well as having advanced testing and analytical facilities and capabilities. The AWRI is an 'industry owned' research body, and so has a focus on both research and industry relevance of that research. On the viticulture side there is an array of players, universities, state government agriculture departments, and the CSIRO, who provide between them R&D with all time lines and a wide range of approaches. Unlike wine, whose knowledge base is specific, viticultural researchers can access a much wider research base than that of general agriculture. All of these players perform the search and validation functions through the general academic research system, and in particular the AWRI through its testing acts as a certifier of validity for new information.

The wine industry then relies heavily on extension to bring the research results and other key information to practitioners, where extension is defined as 'industry development through information management and human capacity improvement' (Drew 2003, p 1). The aims of extension are to bring research results to practitioners, technology transfer, community development and as an education process (Drew 2002). On the wine side, technical extension is through the AWRI, which has easy internal access to its own researchers, and the global research wine research base. Over a four or five year period, they present in all regions in Australia, and to most winemakers. The AWRI is thus able to influence winemaking across Australia in a coordinated and targeted manner, and has evidence from wine testing that they have been successful. Non-technical matters rely on the state governments and recently on a federal program for business management for small wineries. On the viticultural side there is an array of players, state governments, the CRCV and the Wine Industry National Education, Training Advisory Council (WINETAC) who coordinate, fund and provide technical and other extensions to growers. Extension leads to the majority of practitioners having regular access to current information on best practice, and thus drives continuous improvement across the industry through absorption of that information, and its use by the practitioners.

The education system in the wine industry covers the VET system, and the universities. Through WINETAC, training packages for the VET system are created, linking researchers and extension to vocational training. The universities offer a range of degrees in viticulture and wine science, with a boom in the number of universities since 1990. Australia has a science-based curricula, which for decades has emphasised advance in knowledge and constant experimentation, with historically more winemakers than viticulturalists being tertiary educated. There has been an increase in the number of tertiary trained viticulturalists recently, with increased demand, especially from the larger companies. Through this system practical and theoretical knowledge is transferred to practitioners, as well as attitudes of rigour, experimentation and learning. The students are employed in firms, with their knowledge and attitudes from education developing the firm's competence.

A key institution in the industry is networking. There are close networks in local areas, year groups from courses, and within larger firms, and many weak ties across the industry through committees, boards, friendships and other mechanisms. This gives the industry a social capital with advantages of dense interconnected networks (Coleman 1988), and of weak ties (Granovetter 1973; Granovetter 1985) signifying structural holes (Burt 1992), leading to something similar to the small worlds' phenomena (Watts and Strogatz 1998; Verspagen and Duysters 2004). A yearly publication, *The Wine Industry Directory* (Winetitles 2003), lists all the wineries in Australia, and the winemaker and other people at each one. Winemakers refer to it as their 'bible', which they use to find the names and contact details of other winemakers who they feel they can call for advice if they need it. This aspect of the network is underpinned by an attitude of collaboration in winemaking across the industry. In fact winemakers will sometimes share what are virtually trade secrets, in the expectation that others will share their knowledge in return. This leads to the transfer of personal knowledge and experience between trusted colleagues and the rapid dissemination of information in informal networks. As well these networks allow the whole of industry structures to function much more effectively through shared attitudes and the ability of individuals to interact through the networks.

The industry has developed a set of regular publications, produced largely by 'Winetitles' a dedicated publisher for the industry. Further, actors regularly participate in conferences and seminars, which means that information is disseminated across the industry regularly, efficiently and effectively. In addition, professional associations have a significant impact on information dissemination, especially the Australian Society of Viticulture and Oenology (ASVO). This association provides a neutral territory where discussion and dissemination of new information can occur. Contributors and presenters are almost always people with experience, qualifications and expertise, and thus considered valid and worthy of attention. An informant with 30 plus years in the industry said that 30 years ago she couldn't find out much that was publicly available, now 'there is no excuse not to know'. Virtually all information needed by practitioners is regularly and freely available.

The wine industry has other important institutions, which guide behaviour in the industry; attitudes of collaborative competition, being forward looking and the Strategy 2025 document. Collaborative competition is a key, an explicit attitude in the industry, where players collaborate to advance the whole industry until the wine is in competition in the market, then compete tooth and claw. The industry attempts to formally support this attitude through the industry associations and informally through shared norms and values. There is also the acceptance that key individuals can have a significant impact on what the industry sees as the future and that people who stand out are listened to rather than simply slapped down. Certain key individuals have had a significant impact over time on the industry, especially certain wine writers. Len Evans is the best example of this, he pushed Australian winemakers to produce wine comparable to the best in Europe, and initiated the creation of Strategy 2025, discussed shortly. Wine writers also help to construct the value associated with wine by consumers, so fashions and desires for certain wines are partially shaped this way, with the resultant demand driving the firm's development of competence and thus the system and other organisations that serve the industry.

Winemakers in Australia are forward looking, aiming to always improve, whereas in other nations this is not so true. A common comment made during research was that when talking to foreign, especially European winemakers, they would say that the best wine they made was 'the 1981 which got all of the acclaim', or 'the 1952 my grandfather made', whereas an

Australian would say 'I haven't made it yet'. Australians aim to make a better wine every year, Europeans aim to make the same wine each year.

Strategy 2025 (WFA 1996) is a 30 year strategy document for the entire industry, designed to shape the industry such that it becomes 'the world's most influential and profitable supplier of branded wines, pioneering wine as a universal first choice beverage' (WFA 1996, p 4). To do this the industry has to adopt the mission of 'total commitment to innovation and style from vine to palate' (WFA 1996, p 4), with 17 competitiveness factors being considered ranging from choice of grape variety, to human and institutional factors, then market factors such as image, branding and distribution and scale. This document is the result of a process run by the Winemakers Federation of Australia (WFA) with the aim of providing a unified long-term vision for the industry and supporting infrastructures, such as the research and educational systems. During research it was found that many people not only knew of Strategy 2025, but were consciously working to it, that is individuals far from the higher echelons of strategic power used Strategy 2025 as a guide to what they should do, and thus move the industry forward. That this document was created, with such a wildly extravagant goal, and that it has been accepted and mostly internalised by the industry shows how the Australian attitude strives to be at the forefront of the global industry.

In terms of the four phases of absorptive capacity presented previously, a system absorptive capacity search is through organisations dedicated to creating and finding new knowledge. Validation occurs through organisations and institutions dedicated to ensuring validity of public data and information. In the wine industry there is a well-organised array of players who repackage the information and knowledge for absorption and use by firms in the industry. Feedback loops to maintain this system are used both for specific information channels and to help coordinate the whole system.

Conclusion

The contribution of this paper is to extend the notion of absorptive capacity through the concepts of extended and system absorptive capacity, so as to look outside the firm, and then to link that to the competence of the firm and its value offering to the market. A four phase model of absorptive capacity was developed. Underpinning all this is the concept of the Competence Development System, briefly discussed. The Australian wine industry has been used to explicate these concepts.

These notions of extended and system absorptive capacity bring the wider system that shapes the knowledge that a firm has at its disposal into view. Most of the resources used by firms are fashioned externally, simply put people don't grow up inside a firm, they have a wide range of formative influences, including education, firms are surrounded by suppliers, competitors, regulators and many other organisations, and most importantly by their customers. Firms are the nexus through which this abundant array of resources are combined and transformed into the ability to provide goods and services, as Metcalfe (2002, p13) said, 'In its combinatorial role the firm is a unique organisation.'

Extended and system absorptive capacity are concepts that allow an extension of the development of firm competence to be more fully traced to their sources, outside the firm. Firms do have to create their competitive advantage internally, but based on the competence development system they are embedded in. A full understanding of what happens inside requires a more full understanding of what happens outside.

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