

INNOVATION HOT SPOTS: CLUSTERS OF ENTREPRENEURIAL ACTIVITY, BUSINESS AND SPATIAL DEVELOPMENT

By Klas Eric Soderquist, Konstantinos Kostopoulos and Ioannis Katsikis

Fast-growing, geographically and industrially clustered firms are becoming an increasingly important factor for innovation and urban or regional development. Coined by researchers R. Pouder and C. St. John (1996) of the Clemson University, USA, the notion of *Innovation Hot Spots* is today frequently employed by policy makers, regional and local authorities searching to promote growth and development in a region, as well as by business leaders searching to identify attractive locations for their businesses. An innovation hot spot:

- Concentrates competence and innovation capability in a specific product or service business;
- Consist of a cluster of firms in complementary industries serving that product or service business;
- Maintains high competition between an important number of firms within each of the complementary industries;

- Presents a high rate of new venture creation (start ups and spin-offs);
- Presents favourable dynamics of co-evolution, or, more simply speaking, integrated development and reciprocal support between firms, industries, institutions, universities, public policies and political initiatives;
- Provides an environment with superior quality of life attracting and maintaining highly qualified workforce in the region.

As a result of the above conditions, innovation hot spots enjoy rapid growth, leading to job creation, knowledge development and, in the best cases, sustainable urban expansion.

Some well-known innovation hot spots today are *Silicon Valley* with Information Technology and Information Systems, the *Dublin* region in Ireland for electronic components and business services, the *Milan* region in Italy with industrial design, the *Geneva* -



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EDITORIAL NOTE

Welcome to the seventh issue of InnKnow FORUM that introduces a slightly revamped format. After our series of six focused issues, reflecting the major research areas in the Innovation and Knowledge Management Center, the FORUM will from now on comprise articles related to different subjects within these areas of interest. Nevertheless, we will continue to emphasize particular topics through the lead article in each issue and presentation of weblinks related to that subject.

For this issue the lead article relates to regional innovation dynamics and more specifically explores the increasingly important phenomena of "Innovation Hot Spots".

The second article also relates to the theme of innovation. Ioannis Katsikis explores the importance of local knowledge as a means for developing innovation-based competitive advantage in regional production systems.

George Ioannou, Katherine Pramataris and Gregory Prastacos present in the third article the second part of their study of the use of Quality Function Deployment (QFD) in website development. They illustrate the method with a case example from an e-commerce retail web site.

Klas Eric Soderquist

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Zurich axis in Switzerland for Biotechnology, the Amsterdam region in Holland with cut flowers, the Linköping region in Sweden with aviation industry, and the Basque region in Spain with automotive components. New innovation hot spots also emerge rapidly in India, China and Russia, and some of the most attractive in IT- and Telecom-related products and services already exist in Taiwan, Singapore and South Korea (c.f., e.g., Business Week, 11/10/04).

First and foremost, the focus on hot spots of clustered firms and organizations provides a new and more dynamic perspective on business growth compared to the traditional focus on branches or sectors. Further, in terms of innovation systems (c.f., e.g., Carlsson et al, 2002; Chung, 2002; Moulart, 2003; Porter & Stern, 2001) the innovation hot spot is situated in the intersection between national, regional and industrial innovation systems. Hence, it can combine the best of:

- National support for basic research and venture funding,
- Regional development incentives, transport and communication infrastructure, access to qualified workforce and access to a local market,
- Privately funded and driven R&D within established industry structures.

In view of the socio-economic importance of innovation hot spots, it is in the interest of countries, and regions in particular, to promote the development of such clusters of dynamically evolving businesses and institutions. The European Trend Chart on Innovation reflects this concern (European Union, 2004). The objective of this initiative is to identify the European Union's most innovative firms, sectors and regions in order to better understand how favourable conditions for innovation hot spots can be developed.

The Athens-Attica Region in Greece – An IT Innovation Hot Spot

The most recent European Trend Chart Report (December, 2004) presents Greece, followed by Belgium and Finland, as innovation leader in the computer services sector. Computer services enjoy a high knowledge creation and knowledge diffusion intensity, meaning that the hot spots exploiting such services position high on an innovation intensity scale (ETCR 2004), something that provide additional benefits to the regions hosting such industries. More specifically, the number one position of Greece in the computer related service activities is translated through the country's lead, compared to the other EU countries, in:

- Number of SMEs cooperating within the sector,
- Innovation expenditures,
- Share of firms that receive public innovation support,
- Gross investment in machinery and equipment,

- R&D expenditures, and
- Growth rate of employment.

The Region of Attica, which includes the greater Athens area, is about 3.800 square kilometres and represents about 4 million people, which is close to 40% of the Greek population. The Attica basin is the urban conglomeration of the cities of Athens, Piraeus and suburban municipalities. Most public administration institutions of the country are located there. Furthermore, the Attica region counts for the dominating part of national financial and commercial activities (e.g., 55% of the banking activity, 80% of the heavy industry, 80% of the seaborne commerce, etc.). There are 11 Universities, covering all sciences, and offering well-educated human capital and supporting research activities.

The IT sector in the Attica region concentrates competence and innovation capability in products and services, creating new business opportunities and contributing significantly to employment growth. As emphasized in the Federation of Hellenic Information Technology and Telecommunication Enterprises reports, growth has been boosted by the Information Society Program and the Olympic Games, in which the contribution of technology was of great importance (SEPE, 2004). The IT and Telecom sectors are expected to keep up their high growth momentum with a 2005 forecast of 7% and 4,7% respectively. IT services is the sub segment where the biggest growth is expected; 9,3% in 2005.

Consulting, implementation, operations and support services are all likely to enjoy similar growth since they are complementary industries forming the Attica IT innovation hot spot. This gearing-up of a wide range of players in the ICT cluster is a key characteristic of sustainable growth. ICT expenditure in Greece now stands at 5,3% of GDP. As a growing industry, it attracts more and more qualified human capital. It is estimated that over 100,000 people are already employed in more than the 400 ICT firms in the region.

Moreover, the Attica region presents a favourable macroeconomic environment characterized by high rates of development, increase of consumption and investments. In parallel, the necessity for modernization of Greek firms leads them to privilege investments in new technologies. European Union's Grants, through the 3rd Community Support Framework (2000-2006) and the Information Society Program in particular, result in the dissemination of the "Information Society" concept in Greece - in public administration, firms and in the population itself.

The "Information Society Program" in Greece was launched by the government for the development of the IT profile of the Hellenic society. It reserves 27% of the total community financing (through 3rd CSF) for IT investments in a country that represents only 3% of the European population. It supports



activities in education and training, culture, e-governance, transportation, e-business, infrastructures, etc. This direct financing scheme has led to the creation of an important primary demand for IT services, which maintains high competition between the important number of firms within each of the complementary industries in the Attica ICT cluster.

Maintaining the Dynamics in the Hot Spot

Research conducted within the InnKnow Center is preoccupied with analyzing and proposing frameworks for maintaining the dynamics in innovation hot spots. There is a significant risk of rise-and-fall patterns occurring for innovation hot spots, leading to former hot spots transforming into "blind spots", and core competencies developed turning into core rigidities and cultural lock-in (Pouder & St. John, 1996, Leonard-Barton, 1992; Christensen, 1997). When this happens, firms fail to renew their resource base, strategies and structures, leading to a failure to adapt to environmental changes.

Several academics and practitioners (e.g., Nelson, 1995; Edquist et al., 1998; Woolthuis et al., 2005) argue that declining hot spots might be revived by local economic development policies designed to stimulate R&D including:

- Training of the local labour force,
- Business support services to guide reorientation and restructuring efforts,
- Public sponsorship to encourage joint ventures and alliances,
- Effective management of the local infrastructure,
- Development of science parks.

Nevertheless, institutional support interventions may turn into artificial breathing, which only prolongs the pain of an uncompetitive business infrastructure. As highlighted by many researchers (e.g., Scott, 1992; Pouder and John, 1996; Carlsson and Jacobsson, 1997) collective efforts by policy makers and communities to guide hot spot behaviour may finally lead to isolation of the hot spot from real competitive forces and to encourage sameness among hot spot competitors. In order to remedy this risk, important factors for sustaining an innovation hot spot include:

- The development of entrepreneurial spirit within all spatial dimensions, i.e., firms, organizations, industries, regions and countries.
- The integration of local knowledge and local resources in the innovation processes (c.f., the following article in this issue of InnKnow FORUM).
- The co-evolution of innovation dynamics between firms, industries, institutions, universities, public policies and political initiatives.

- The ability of firms to switch partners and reduce dependence on certain dominant organizations (not only at the country level but also in the global market).
- The capability to respond to market trends and consumers needs.
- The development of capabilities (not only technical but also organizational) lying outside the existing structure of firms' skills.

The Future of IT Hot Spot in the Region of Attica

After the Athens 2004 Olympic Games, the IT sector seems to face a critical challenge in maintaining its dynamism and growth. The sustainable development of the sector has to prove itself by increasing its contribution to employment through more job creation and through the geographical expansion and formation of partnerships with diversified external organizations. The ultimate goal is to sustain its openness to both market trends and consumers needs.

The major field for development remains the software industry. The most important markets for future development still include the public sector, manufacturing, banking services, food and beverages, pharmaceuticals, health and insurance services; while major products include ERP and web applications, data bases and CRM, internet and security applications.

Finally, the major opportunity for future development can be the enlargement of the European Union, where Greece enjoys a strategic positioning as a trampoline for Balkan business expansion and the dissemination of IT in sectors of the economy where the need for developing technology is large, such as in agriculture and tourism.

LOCAL KNOWLEDGE AND REGIONAL PRODUCTION SYSTEMS: THE CASE OF THE NORTH AEGEAN REGION

by Ioannis Katsikis

Traditionally, local knowledge used to be the main resource for regional enterprises. The opening of local production systems to national and international trade systems has replaced local knowledge with external knowledge inflows as major source for innovation and growth, resulting in the weakening of those mechanisms, such as tradition and local culture, that produce local knowledge.

This article is based on a paper by Katsikis, Kizos and Spilanis, (2004), which presents the results of a research conducted in the North Aegean Region. The purpose of the paper was to question whether local knowledge can still serve as a significant



resource and a means for innovation for local enterprises in the North Aegean Region, capable of offering competitive advantages such as quality improvement and diversification of products and services. With the use of a structured questionnaire, 94 small and medium-sized food and beverage production companies in the North Aegean Region were surveyed. The Region is a relatively closed production system, characterized as less favored area (LFA), due to its insularity and isolation. This fact, combined with the absence of enterprise networks, clusters, or support structures, leads to a production system with small external knowledge inputs.

Local Knowledge

Local knowledge is a territorial located resource and a unique asset for both regions and enterprises. It can be seen as a part and at the same time an output of traditional cultures, and its embeddedness in the production process can offer important competitive advantages for both enterprises and regions. Local Knowledge, as knowledge itself, is deeply spatially embedded. At the same time it constitutes a key organizational resource that is expressed through the procedures of an organization and its production processes, and is embedded in products and services developed and produced (Nonaka & Takeuchi, 1995).

Knowledge is rooted in people and it can't be created by itself, without the initiative of an individual and the dynamic interaction that takes place in a group of people (such as an enterprise, an organization or a community). Local knowledge, additionally, is crystallized at a spatial level and as a spatial characteristic is connected directly with a specific place. Therefore, it can be considered as a non renewable resource and a spatially oriented human product. By these terms, locality defines knowledge and at the same time knowledge defines locality (Katsikis, 2003).

Local Production Systems and Sustainability

Traditional local cultures are often perceived as positively associated with sustainable development for two sets of reasons (Jenkins, 2000). The first relates to the existence, in non-industrial societies in particular, of what Milton (1996) terms as "primitive ecological wisdom". Such wisdom is often assumed to be negatively correlated with the extent of traditional societies' external links. That is, the more external links the traditional society "enjoys", the less the role and importance of the primitive ecological wisdom. Dasman (1976), for example, contrasted "*ecosystemic*" societies living within an ecosystem upon which they depend for survival and towards which they are presumed to behave responsibly, and "*biospheric*" societies linked into global technological and trade systems and therefore less constrained to sustainable behavior. "Ecosystemic" populations do not radically modify their environments over time. For a significant proportion of humanity, until comparatively recently, traditional practices appear

to have led to a long-standing, yet productive, relationship with natural resources.

The second set of reasons for viewing traditional cultures as sustainable (Jenkins, 2000) results from the perception of such cultures as established "systems of values, beliefs, artifacts and artforms which sustain social organization and rationalize action" (Norgaard, 1994). The systems view goes beyond cultures as collections of separable behavioral, perceptual and practical phenomena and emphasizes mechanisms of their self-organization leading to the emergence and maintenance of sustainable structured and bounded relationships. By contrast, de-territorialized non-traditional cultures generally have negative associations with sustainability because of their shortcomings as systems (Jenkins, 2000).

Product Innovation and Local Knowledge

According to Nonaka (1991, p.25) the essence of innovation is to "recreate the world according to a particular vision or ideal". Innovation signifies the transformation of scientific and technological knowledge into products and services, and in this sense the term describes a process (European Union, 1996). However, when it designates a new product, then the emphasis is on the result of the process (Komninos, 2002). Innovation is the fruit of diversity; the introduction in the economy of "new productive combinations" as originally defined by Schumpeter (1911). The major source of diversity and new productive combinations is knowledge activated for the purpose of creating competitive advantage. Now, it can be argued that local knowledge, when analysing a specific industry, can be a source of diversity. For example, the specific knowledge about the relationship between the quality of fabrics and the methods and procedures employed in breeding sheep and "harvesting" the wool provides scottish entrepreneurs with a unique advantage in woolen cloths. Similarly, the local knowledge held by wine farmers in Crete, accumulated through generations, enables sustainable growth while maintaining unique product advantages in terms of taste and purity.

Hence, local knowledge can create innovative products and local territorial conditions can encourage the process of knowledge creation as the essence of locality provides the common framework in which the members of a community interact and create new insights which are then experimentally implemented while respecting strongly validated traditions. Local knowledge is activated between local resources and local products (Figure 1). The interaction between local resources and local knowledge is a two way procedure. The availability of resources defines local knowledge, which at the same time has the power to change the nature of the resources in order to produce local products. Similarly, the interaction between local knowledge and local product is equally twofold. Local products are defined and realized with the use of local



knowledge in the production process, but feedback from product users alsomight lead to changing the formula that they are made of, hence impacting on the local knowledge itself.

As illustrated in Figure 1, the "space" between resources and knowledge is where sustainability is maintained with respect to how local resources are used in correspondance with local knowledge. Further, the "space" between knowledge and products, is where innovation can be developed. The process as a whole conducts to sustainable regional development.

The North Aegean Region

The North Aegean Region is an insular region with three Prefectures and 10 inhabited islands. Apart from inter-islands communication and transportation difficulties due to insularity and great distances, the relief in the bigger islands (high mountains, steep slopes) creates intra-island infrastructural difficulties (Kizos et al, 2003). The region stretches over 3.836 km², with a total population (2001) of 205.237 and population density of 52,1 inhabitants/km² (Greek average is 82,9). The population decline reached its peak in 1981 and since then the population is slightly increasing (1,9% in 1991-2001), but the quality indicators (age structure and employment) are deteriorating. For example in 2001, 21% of the inhabitants were older than 65 and the employment rate 35% (17% and 42% respectively for the Greek national average. Agriculture covers a greater part of the Regional GDP than the Greek average (10% against 7,8% respectively), industry contribution is small while the services sector covers 71% (against 68% for Greece) with the most important sector being tourism (Kizos et al, 2003). A closer look at the local enterprises reveals that food (olive oil, cheese and mastic), beverages (wine, ouzo) and tourism are the only local productive sectors (apart from trade) and account for almost 25% of the total of the number of enterprises and 17% of the total turnovers. Trade is the predominate sector, covering 40% of the enterprises and 58% of the turnover.

Survey Results

Data on innovation, the use of local resources, the use of local knowledge, the production of local products, and the problems that enterprises face

was collected through interviews following a structured questionnaire. The sample was chosen from the Enterprises Registry of the Prefectures and included enterprises representative for the local production tissue as described above. 94 exploitable questionnaires were used for the reporting in this article.

Initially, results show that the procedures through which local knowledge is transferred through generations has changed. In the past, family heritage of the business was the most important procedure, followed by apprenticeship of employees external to the family. Today, the importance of family heritage has declined by half and apprenticeship appears to be the main procedure, with vocational training coming third (Table 1).

	First acquired	Transferred today
Family Tradition	55%	35%
Apprenticeship	30%	40%
Vocational Training	6%	16%
Other	9%	9%

(76 respondents)

Table 1: How the knowledge of production process was first acquired and how it is transferred today

Results concerning innovation demonstrate that about one third of the surveyed enterprises have actually introduced innovations, while another third plan on introducing some type of innovation in the near future (Table 2). It is to be noted that a significant number of enterprises What should be noted here is the significant number of the enterprises that did not answer the innovation questions (35-40%).

	Introduced innovations	Planning innovations
Yes	33%	32%
No	32%	28%
Not answered	35%	40%

Table 2: Innovations Implemented and Planned

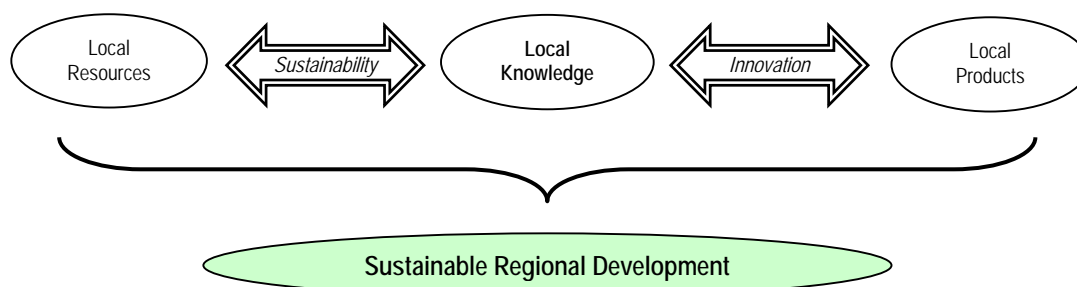


Figure 1: Local Knowledge in relationship to resources and products



We further investigated to what extent innovations were introduced or planned to be introduced as a result of customer feed back and pressure for improvement and/or change. About one third of the companies that were preoccupied with innovation indicated that customer interaction was the major source. This in absolute numbers relatively low number (about 20 of the 94 sample companies) can be regarded as an indicator of the closed character of the production system of the Region. The categories of the innovations that have been introduced also demonstrate this closed character. Most innovations refer to standardization technology and/or safety designation schemes and only a limited number concern new production development or diversification (Table 3).

Innovation Categories*	%
Standardization	38%
Collection of raw materials	20%
Commerce	18%
Manufacturing	18%
Warehousing	6%

* Different categories can refer to the same enterprise

Table 3. Product Innovations Categories

This "innovation shortage" appears to be both a cause and a result of the physical disadvantages of the Region. This belief is strongly defended by the owners of the enterprises in discussing the obstacles for introducing innovations. They feel that the physical disadvantages of the Region cause several economic and practical difficulties (increased costs, distribution difficulties, etc.) that innovation comes lower in priority. Therefore, almost six out of ten believe that economic obstacles are the main reason behind this innovation shortage and only 10% declare that they need more information on possible innovation pathways.

Data on the procedures that enterprises use in order to integrate external knowledge with local knowledge reveal that 20% of the respondents have proceeded to a modification of transferred technology by integrating it with local knowledge. This may be a result of market standardization pressures or of a lack of local diversification of procedures and products leading to under-utilization of local knowledge.

Two significant issues are highlighted by the present study:

1. This relatively closed and locally oriented production system preserves significant reserves of local knowledge transmitted through family heritage and apprenticeship.

2. Nevertheless, the region is not strong in developing innovations from a combination of local and external knowledge. Hence it can not yet qualify as a 'learning region'.

The major risk in the local production system is that local knowledge can be left out in favour of easy-to-use "turn-key" processes and technologies transferred from outside the local system. As long as transferred knowledge represents improvements and leads to an upgrading of the production system the effects would be mainly positive. The danger lies in the loss of unique competencies and local knowledge if no explicit efforts are undertaken in order to integrate local and transferred knowledge for creation of unique local competence. In that case, in spite of the preservation of local knowledge reserves, threats to local uniqueness are clearly present.

We conclude that in view of the importance of local knowledge for sustainable innovation-based regional development, it is of utmost importance to emphasize the role that it can play and develop policy instruments that can contribute to promote, renew and integrate this knowledge in modernization and upgrading efforts of regional production systems.

The authors would like to acknowledge the N.A.I.A.S. Project (North Aegean Innovative Actions & Support, www.naias.gr) funded from the European Commission and the Hellenic Republic, Ministry of Economy and Finance that financed the survey presented.

The article builds on a paper by Katsikis I., Kizos Th. and Spilanis I., entitled "Local Knowledge as a Competitive Advantage and Innovation Tool for Regional Production Systems: The Case of North Aegean Region, Greece", presented at the "International Conference on Information Systems and Innovative Technologies on Agriculture, Food and Environment", 18 - 20 March 2004, Thessaloniki, www.epegenorth.gr.

A QUALITY FUNCTION DEPLOYMENT APPROACH TO WEB SITE DEVELOPMENT (PART II)

By George Ioannou, Katherine C. Pramataris and Gregory P. Prastacos

In the previous issue of InnKnow FORUM (no 6, Fall 2004) we presented the general Quality Function Deployment methodology and discussed how QFD can be used in website design. In this article we present a case study of how the QFD methodology was applied to the design of an electronic retail web site.

The terms "electronic retail site", "e-shop", "online retail store" and the similar have emerged lately to describe web sites with e-commerce capabilities, i.e., sites where the visitor can get support throughout the buying process - from the need recognition phase to product purchasing and post-purchase support (Vrechopoulos et al, 1999). There



are large differences between a physical store and its electronic counter-part. A help button on the home page of the Web shopping site replaces the sales clerk's friendly advice and service. The familiar layout of the physical store becomes a maze of pull-down menus, product indices, and search features. The promise of electronic commerce and online shopping will depend to a great extent upon the interface and how people interact with the computer (Lohse & Spiller, 1998). Despite the possibilities offered by technology, Spiller and Lohse (1998), in their study of 137 Internet retail stores, show that there is still long way to go in order to meet consumer expectations regarding online shopping.

Looking at the pertinent literature, Lohse & Spiller (1999) identify four groups of electronic shopping attributes that designers need to pay attention to in order to improve customers' experiences:

- *Merchandise variables* that measure product selection, assortment, quality, guarantees, and pricing.
- *Service variables* that examine general service in the store and sales clerk service for merchandise return, credit policies, etc.
- *Promotion variables*, which record sales, advertising, and appetiser features that attract customers (e.g., a "What's new" section).
- *Navigation variables* that include store layout and organisation features.

In a virtual retail store, merchandise variables, and more specifically the product assortment, affect all three characteristics of content, performance and usability, defined in the previous article as the key website characteristics that must meet customer requirements. Obviously, the content of a web store refers mainly to the product categories and the individual items this store offers for selling. On the other hand, the greater the number of products and the amount of information maintained per product, the lower the system performance. Apart from the overall system performance, the number of product hierarchies and the number of products per web page also affect the time delays and usability perceived by the user while waiting for product pages to download.

The service features of an e-store are mainly associated, in a positive relation, with the content of the web site. However, too many service features, especially when these appear on most of the site pages, may result in information overload and greater page-download delays for the user. Examples are links to "Frequently Asked Questions", "Contact us", "Gift services", "Sales Representative", etc. appearing on all product pages or extra get-to-know the customer questions.

Promotion features have, in most cases, a negative relation with the characteristics of performance and usability. Banner advertisements and other promotional features result in bigger page sizes and

thus lower response times. The aesthetic need for advertisements to have high quality graphics, animation and eye-catching features deteriorate this situation even further. These same features, especially on banner advertisements, tend to confuse the user as they attract the eye away from the core page content and result in poor site usability (Nielsen, 1999).

Regarding the value offered to the web store customer in terms of content, this may be both negative and positive. While many e-shoppers have a negative attitude towards banner advertisements, others are indifferent or want to get informed about new products and discounts. At the same time they all seem to appreciate the "special offers" and the "what's new" section in a retail site (Lohse & Spiller, 1998). Shopping recommendations, when well targeted and meaningful, may also be perceived as a service by the e-shopper (e.g., www.amazon.com).

Navigation variables greatly affect the usability of the web store. It is associated with the hierarchical structure of product categories and the amount of information appearing at each level. For example, if the price, size and brand of a product is shown at the products-listing page and the customer can purchase an item at this level, this will save him/her an additional 'click', which is translated into greater usability. However, at the same time the products-listing page becomes quite big, takes longer to download, while part of its content is only visible after the user scrolls down. We thus define a weak negative relation between navigation variables and performance and content. The latter negative relationship is also supported by the fact that the greater the amount of information (in our case products) at a site, the more difficult the navigation becomes.

The combination of all the above result in the 2nd phase House of Quality (the first phase was explained in the article in InnKnow FORUM no 6) depicted in Figure 2. For example, the characteristic *Content* is strongly related to the design attribute *Merchandise Features* since the content of an e-retail store is defined by the breadth and depth of its offerings to the end-customer. On the other hand, *Content* has a medium correlation with the design attributes *Service Features* and *Promotion Features* because although both these attributes affect a retail store's *Content*, they are not the key factors in defining the essence of this characteristic. Finally, the design attribute *Navigation Features* is negatively related to the characteristic *Content* since the larger and the more information rich a retail site, the more complex its structure and the more difficult the navigation through the site by the end-customer.

The symbols associating retail site design attributes with web site characteristics in the centre of the House of Quality are justified by the discussion above. Customer priority has been set to high for all site characteristics, as these have been identified as



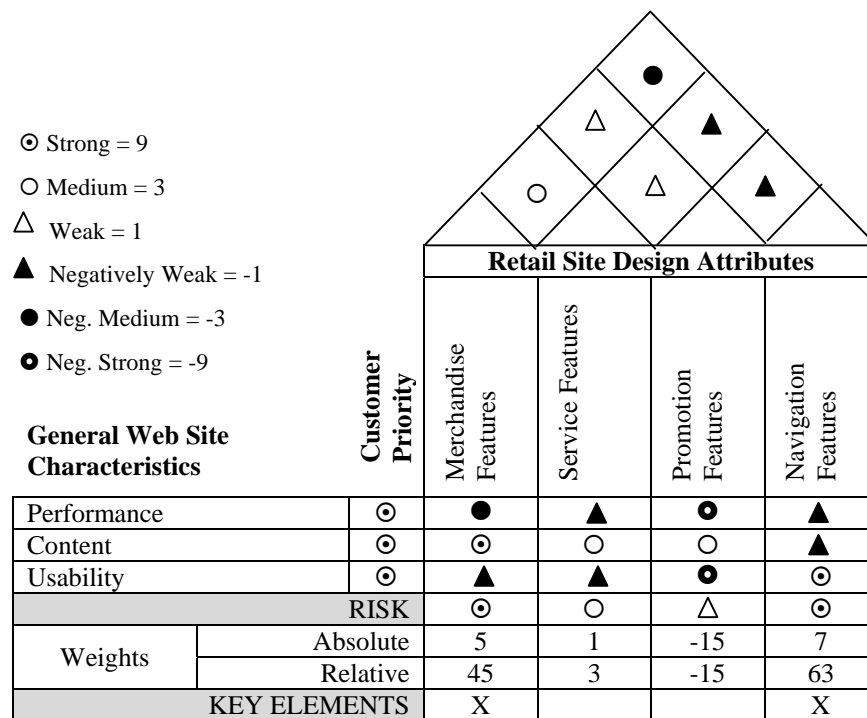


Figure 2. Web site House of Quality – 2nd phase for an electronic retail store

the key elements during the previous QFD phase. The third type of input in the above House of Quality, the values of "RISK", are based on the findings of Lohse & Spiller (1999), whose study identified the following regarding the four categories of design attributes we examine here:

- Merchandise: Additional products in the store attract more traffic (17%).
- Service: Featuring a FAQ section in the store is associated with more traffic (54%); Providing a feedback section for customers is associated with lower traffic and higher sales (1%).
- Promotion: Appetiser information has no significant effect on traffic or sales; The number of featured products along departmental navigation path has no significant effect.
- Navigation: Improving the browsing and navigation capabilities of stores and especially product lists can generate significantly higher traffic and sales (61%); The number of levels between home page and end product pages has no significant effect on visits and sales; Consistent menu bars have no significant effect in the models.

For those variables above that are significant, the numbers in parentheses represent the variance in the store traffic or monthly sales explained by the corresponding variable. As Lohse and Spiller (1999) comment in their study, we should not expect a causality relation between the existence of a FAQ section in a store and sales or traffic. It is more probable that a FAQ section is added to cope with high traffic generated by the customer feedback

section. We thus conclude that, based on the above study, merchandise and navigation features are the most important in driving web-store sales and traffic and are thus associated with higher risk. The calculations of the absolute and relative weights of the House of Quality of figure 2 follow the method described in the previous article.

Building further on the findings of Lohse & Spiller (1999) and the design variables they define, we can derive the 3rd phase House of Quality for an electronic retail store of Figure 3. On the left of the House of Figure 3, we place the key design attributes that we identified during the second phase of the QFD methodology that is *Merchandise Features* and *Navigation Features*. On the top of the House we present some of the specific design variables associated with them, as defined in the Lohse & Spiller (1999) study, i.e.:

- a. *Number of Products in the Store*, a measure of the breadth of the store's assortment.
- b. *Number of Product Hierarchies*, a measure of the store's organisation and depth structure.
- c. *Lines of Product Information*, a measure of the content provided to assist the buying process by the end customer.
- d. *Different Shopping Modes* that relates to the flexibility and adaptability of the retail store to the customer's habits and possible needs.
- e. *Number of Links* that is a measure of the navigational effectiveness of the retail store.



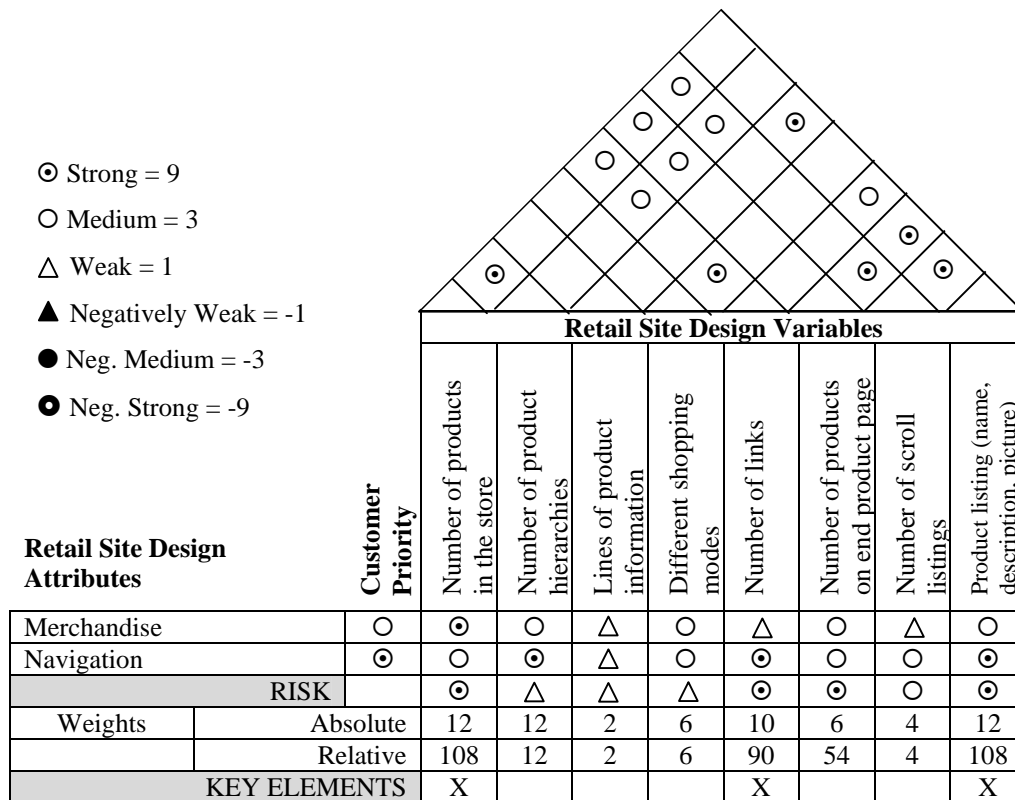


Figure 3. Web site House of Quality – 3rd phase for an electronic retail store

- f. *Number of Products on End Product Page*, which is a measure of the organisational hierarchy of the product offerings and relates to the “easiness” for the customer to identify what he/she would like to buy without resorting to several clicks and having to go through multiple overloaded pages with information concerning groups of products.
- g. *Number of Scroll Listings* that defines the compactness of information presentation and relates to the navigational effectiveness and usability of the site.
- h. *Product Listing (Name, Description, Picture)*, which is a measure of the quality and “smartness” of the presentation of the products.

The above design variables that are presented in Figure 3 on the “roof” of the House of Quality are now very concrete and measurable elements that have either a negative or positive, weak or strong relation with the key design attributes previously identified. In particular, the design attribute *Merchandise* is strongly related with the design variable *Number of Products in the Store*, since by definition this is the variable that characterises the product assortment. A strong relationship is also established between the design attribute *Navigation* and the site design variables *Number of Product Hierarchies*, *Number of Links* and *Product Listing*, as each of the latter variables strongly affects the path followed by the customer within the site in his/hers effort to fill the shopping cart and complete the buying process.

Using a similar approach and findings as we have in the previous phase of the QFD methodology, we distinguish the *number of products* in the store, the *number of links in the site* and the *type of product listing* as the key elements that influence merchandise and navigation features of an electronic retail store. These measurable variables should be constantly (on-line) monitored throughout the life cycle of the retail store in order to provide meaningful feedback to the store’s decision-makers that are responsible for the store’s offerings to the end-customer as well as for the gross-sales and the overall performance of the Internet shopping outlet. The input from customers concerning these variables is implicit, since it can be only retrieved by processing the number of customer visits, the number of products browsed and bought, the “location” of these products in the site, and the path followed by the customer in order to reach these products. These metrics are easily captured on-line and are stored at appropriate server files (site monitoring tools).

Having completed the three-stage QFD methodology proposed in this paper for the case of an electronic retail store, we are now capable of defining the structured approach for embarking on such designs. Customers require *Availability*, *Functionality* and *Integration of Information*. The key elements in the list of site characteristics that should be addressed to handle the satisfaction of these customer requirements are *Performance*, *Content* and *Usability*. The design attributes affecting the key site characteristics for electronic retail stores are *Merchandise features* and *Navigation features*. These design attributes are, in turn, strongly coupled with



the design variables *Number of products* in the store, *Number of links in the site* and *Type of product listing*. As a result, careful fine-tuning of these design variables and appropriate balance of their values and their relative contributions to the site's presence, structure, aesthetics and content, is necessary to address the key customer requirements.

It is important to note that following the reverse QFD process, i.e., from the design variables to the customer requirements, we can associate the critical measures related to the key elements in the list of design variables with initial customer requirements regarding the services and characteristics of a web site and, more specifically, of an electronic retail site. This reverse QFD process can be the basis of a continuous improvement methodology, applied to web store dynamic redesign and customer profile customisation, following an automated update of the design variables based on the constant monitoring and control of the level of satisfaction of the customer requirements.

Clearly, the user interface is an essential link between the customer and the retail store in Web-based shopping environments. Although it is very important to make a good store design up-front, in order to attract and retain online customers, it is even more important to track the effectiveness and usability of this design and constantly monitor the degree to which it satisfies the basic customer requirements. More specifically, by understanding the effect that the virtual store interface elements have on the consumer buying behaviour, virtual retailers will be able to design their stores more effectively, satisfy their customers through innovative and personalised ways, and gain competitive advantage (Vrechopoulos, *et al*, 2000).

The QFD process, as presented in our two articles, gives electronic retailers and web-site designers a practical and handy tool to identify important design attributes and monitor the extent to which they contribute to the needs of the retail on-line store customers. QFD offers both a structured approach and a visual representation to easily distinguish the key elements that represent the high-risk and high-opportunity areas in a web site's design, as well as the relative importance and conflicting behaviour between alternative design attributes. In that sense, it guides web-site design decisions and supports the development of web sites, bringing to the field of information systems design methodologies experience from the manufacturing industry. However, contrary to the static nature of products, information systems and web sites in particular are a lot more flexible and dynamic in nature. This fact greatly increases the potential that QFD has if used in that context, as it allows for the online measurement of product (site) effectiveness and the dynamic adaptation of product (site) characteristics in order to best meet customer needs.

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USEFUL WEB LINKS

Innovation Dynamics and Regional Innovation Policy

Innovating Regions in Europe, www.innovating-regions.org, The Website of the Innovating regions in Europe (IRE) network is a joint platform for collaboration and exchange of experience for regions that are developing or implementing regional innovation strategies and schemes. Currently, it brings together around 200 member regions from the European Union and the Associated Countries.

European Innovation Portal,

www.cordis.lu/innovation, This Innovation Portal, operating within the Community Research & Development Information Service (CORDIS) (www.cordis.lu), provides access to the latest policy documents on innovation, up-to-date news and events, articles on innovation studies, call for projects and contact information for intermediaries that could facilitate the innovation process.

Organization for Economic Co-operation and Development (OECD),

<http://www.oecd.org>, Under the headline "by topic" and then "Science and Innovation" there is a wide range of innovation statistics, documents, publications, and country reports that aim at examining the role of technology, science, and innovation to boost economic and social growth.

The Smart Practices Innovation Network,

<http://rqsilaval.ca/ang/index.php>, Offers a global coverage concerning innovation issues (studies, articles, research projects, public policies...), and the possibility to subscribe to a weekly newsletter to get the best content from the World Wide Web.

Center for Business Innovation,

<http://www.cbi.cgey.com>, A worldwide network of leading thinkers committed to synthesize change in business with change in management theory. Provides a variety of articles and an on-line journal on business innovation.

SPRU - Science and Technology Policy Research,

<http://www.sussex.ac.uk/spru/>, SPRU's mission is to deepen understanding of the place of science, technology and innovation in the global economy for the benefit of government, business and society. SPRU is one of the world leaders in policy research on science, technology and innovation (STI) and its wider economic, social and environmental implications.



The Institute of Innovation Research – Manchester University, <http://les.man.ac.uk/PREST/>, The Institute of Innovation Research, established in 2003, is one of the key sites in Europe for postgraduate training provision in the fields of science policy, technology management, economics of technological change and innovation studies. The Institute houses a number of major research groups, in particular the Policy Research in Engineering, Science and Technology (PREST), the ESRC Centre for Research in Innovation and Competition (CRIC), and the Centre for Entrepreneurship and Management.

Research Laboratory in Theoretical and Applied Economics – (BETA), <http://cournot2.u-strasbg.fr/users/beta/index.php>, BETA operates at the University Louis Pasteur in Strasbourg and covers a large range of activities concerning basic aspects as well as applications of scientific research in economics and management science. It specialises in fields such as the economics of innovation, evolutionary theory of the firm, management of technologies and environmental economics.

Websites from Greece and of Hellenic interest:

General Secretariat for Research & Technology, Ministry of Development, Greece, www.gsrt.gr, GSRT is the most important public policy making organization in the areas of RTD and innovation in Greece. Through its different programs, GSRT supports research activities of both research institutes and industry, promotes the transfer and dissemination of advanced technologies and contributes to the reinforcement of Greece's research manpower.

The Website for Research, Technology and Innovation in Greece, www.ekt.gr/content/, This website, administrated by the National Documentation Centre in Greece, offers insights into the national research and innovation system of Greece and activities including policies and programs supporting public and private participation, legislative documents, science and technology indicators and various activities for the promotion of scientific and technological culture in the Greek society.

Hellenic Innovation Relay Center, www.hirc.gr, The Hellenic Innovation Relay Center is a one stop-shop for enquires about innovation and technology transfer issues. Its role is to support the promotion and implementation of RTD results, the transnational cooperation and the transfer of technology to SMEs and the demonstration of best practices for the fostering of companies' innovativeness.

Observatory for Regional Innovation and Entrepreneurship Central Macedonia, www.orie.gr, The Observatory for Regional Innovation and Entrepreneurship of Central Macedonia consists of a newly established institution, which aims to support and to promote Entrepreneurship in the Region of Central Macedonia, through the use of capabilities offered by the sector of Innovation. This web site provides useful information about the actions and services offered by the Observatory.

Urban and Regional Innovation Research Unit (URENIO), www.urenio.org, The Urban and Regional Innovation Research Unit is a university laboratory for the promotion of research and supply of scientific and technological services. URENIOs central research themes are cities and regions of innovation, knowledge clusters, technopoles and science parks, regional innovation systems and strategies, digital innovation spaces, and intelligent cities.

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NEXT AND PREVIOUS ISSUES OF INNKNOW FORUM

The next InnKnow FORUM, to be published Fall 2005, will feature articles on different topics. The lead article will be devoted to **Marketing of High Technology Products**.

The focus of previous newsletters, available on our website, was:

Change Management (no 1, 2002).

Strategic Performance Measurement – Balanced Scorecard (no 2, 2002).

Innovation and Entrepreneurship (no. 3, 2003).

Managing Knowledge (no 4, 2003).

Competency-Based Management (no 5, 2004).

New Product and Service Development (no 6, 2004).

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