

KNOWLEDGE ECONOMY AND INNOVATION: A EUROPEAN COMPARATIVE PERSPECTIVE

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ABSTRACT. This paper shall review a number of theories of organizational learning and their connection to forms of work organization, and examine organizational structures and which types of learning tends to be prevalent in their economies. A number of learning frameworks are integrated and examined to identify similarities and differences. A review of the dispersion of organizational forms, adult training and economic performance of selected states within the European Union are examined to discover if there are connections between the all three elements.

JEL Codes: D83, O31, Q55

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1. Introduction

The World Bank's Knowledge for Development program has stated that "The application of knowledge is now recognized to be one of the key sources of growth in the global economy. The term Knowledge Economy (KE) has been coined to reflect this increased importance of knowledge. A knowledge economy is one where organizations and people acquire, create, disseminate, and use knowledge more effectively for greater economic and social development."¹ Knowledge, in the context of business and commerce, is a remarkably difficult subject to have one dominant theory encompassing the acquisition and retention of knowledge in a commercial setting, ultimately leading to innovation, that covers all the different types of organizational designs and

management approaches. Once learned and retained, the diffusion of knowledge creates further challenges due to the differing natures of tacit versus explicit knowledge.

2. Reviewing Literature on Resource, Knowledge and Learning in the Firm

2.1. From Resource to Knowledge-Based View of the Firm

Edith Penrose (1959) stated that a company's success depends upon its possession and development of unique resources. As Dosi, Faillo and Marengo (2008: 1169) ventured, Penrose's view is now aligned with the "Resource-Based View" (RBV) that looks upon organizational knowledge as a corporate resource that is used to create or sustain competitive advantage within the market sector (or sectors) for a firm. This view ties directly into current business strategy theory, and especially that of Michael Porter, whose seminal book *Competitive Strategy* (Porter, 1980) examines the "Unique Value Proposition," "Tailored Value Chain," and "Continuity of Time," all have direct connections to the continuous process of organizational learning in ensuring the survival of the firm. The construct of the resource-based view theorists is that knowledge is a key part of the firm, and the author posits that much of the reviewed literature is written in the context that such knowledge is "owned" by the firm, and little is credited to the individual employees, but more to the organizational habits and management. Different from technological or product design ownership that can be protected by patents, the organizational learning and knowledge base of a firm is generally looked upon as a set of procedures or processes that allow the production of an output that the firm then sells to customers. There is a difference between those researchers who view organizational knowledge as that which resides in the firm itself; "only a company can make a car;" versus those who consider knowledge as inherent in the individual, but shared with the firm as in the case of the J-Form organization.

The Knowledge Based View (KBV) of the firm is a recent development, being solidified in the later 1990's and early 2000's, and is greatly enhanced by the shift of the economies of developed nations from manufacturing to services-based firms (Curado, 2006: 5). Curado (2006: 12) concludes that knowledge in the KBV is the most important resource that a firm can retain. Thus, the intangible, idiosyncratic, and dynamic nature of knowledge makes it more important than any other resource that a firm can muster in the face of competition.

Notwithstanding the RBV and KBV dichotomies, it remains that knowledge, whether in a position of primacy or subservient in the corporate structure, is dependent upon the creation and subsequent retention of knowledge. Academic literature has examined the two foundational types of knowledge; tacit and explicit; in many different manners. From the philosophical approach of Polanyi (1958) to the organizational learning approach of Lam (2000: 506), and the knowledge creation models by Nonaka et al. (1994: 20, 2000a: 23, 2000b: 10), the difference between explicit and tacit knowledge is simple, yet how knowledge is acquired and transferred is complex enough that it has created a unique discipline in the academy.

Tacit knowledge is characterized as a personal knowledge that is learnt “by doing” and the dissemination of the knowledge is not easily achieved verbally or in written form. One example cited in common literature concerning tacit knowledge is the ability to ride a bicycle; one may be able to explain how to ride a bicycle, but controlling the machine takes “hands-on” experience to be proficient. In labor intensive industries such as manufacturing or artisanal sectors, the knowledge is generally tacit and taught through “on the job training” (OJT).

Explicit knowledge is codified and formalized. It can be written, taught, and then understood by others in such form without further explanation. An encyclopaedia is an example of explicit knowledge transfer. Much of the formal sciences education follows the explicit knowledge transfer methodology and is then generally followed by the formalization of professional accreditation in professions such as medicine and engineering through a type of apprenticeship and then qualification exams for licensing.

The tacit and explicit knowledge types are not mutually exclusive though. In most professional settings, a combination of explicit and tacit knowledge is required to be able to carry out employment duties. For example, in skilled building and construction trades training, a requirement of formal theory education during the apprenticeship period followed by qualification exams are required to become a licensed tradesperson.² Tacit and explicit knowledge is combined to provide a way to demonstrate minimum competency. In this way, both the “how” and the “why” are addressed, but at a level that is appropriate for the knowledge required to competently perform the expected tasks.

2.2. Models of Work Organization and Learning

Different firms will be organized in different fashions. The organizational forms listed below more-or-less align to the four types of organizational forms quantified in the 2009 Valeyre et al.’s “Working Conditions in the

European Union: Work Organization,” study that forms the foundation of the Review of EU Work Forms Research later in this paper.

The “J-Form” structure is highly effective in making incremental improvements in existing products or processes, or even management structures. As Lam (2004) indicated, the structure does well in established technological or mature settings where incremental innovation is important. Newer technologies or where extreme dynamic innovations dominate the market sector, the incremental approach does not fare as well. Examples of dynamic fit of the J-form of structure are electronics and automobile manufacturing where there is a set and relatively stable market dynamic and the emphasis tends to be focused on incremental improvements related to cost leadership or changes in the Five Forces of the market (Porter 2008; 27). Industries where the J-Form does not fit as well are where corporate agility and dynamic decision-making are required to foster radical innovation or rapid change (Lam 2004; 11).

Professional Bureaucracies (Mintzberg, 1980; 333–335) can be paraphrased as organizations where specialized explicit knowledge is the basis of the firm’s service offerings such as engineering practices or accounting firms. Actors in this type of organization have a high level of autonomy, but are regulated by specific rules on professional conduct and are legally liable for the outputs of their efforts. The individual experts generally work within a specific subject matter domain, and co-ordination between them causes challenges to innovation. In addition, Moore and Dainty (2001; 559–562) found that “cultural non-interoperability” of professional bureaucracies created barriers to success, and by extrapolation it can be posited to barriers to potential innovation, when dealing with separate discipline-specific firms a having to co-operate in a supposedly innovative delivery methodology.

Machine Bureaucracies (Mintzberg, 1980; 332–336) have a high level of central control and limited employee autonomy as in mass-production firms. Machine bureaucracies are characterized as being designed for stable conditions with efficiency as the prime concern, but are not well suited for addressing change. A parallel can be drawn between the Taylorist form of organization and machine bureaucracies for the centralization of control and setting the capacity of production.

Adhocracies (Mintzberg, 1980; 336–338) are organizations which are generally project-based structures assembled to perform a specific deliverable, and generally under conditions of uncertainty. The teams can be composed of members from differing business units within a firm or from many different firms. The membership of the team can also include many different disciplines or backgrounds, depending upon the nature of the problem to solve. Paraphrasing Lam (2004: 120), adhocracies are difficult to sustain in the long term as the flexibility required to solve immediate needs may lead to unclear

or conflicting management decision making or the lack of unified strategic direction for project selection. Silicon Valley is another example of adhocracies in action, specifically within a local labor market, or community of practice. In Silicon Valley, due to the large specialized knowledge pool, immediate resourcing can be achieved through the high level of expertise available to fulfill a firm’s requirements (Lam 2004: 130). A negative aspect of an adhocracy is that the team member’s knowledge is generally tacit and may leave the organization when they do. In addition, Lam also notes that any explicit knowledge can become diffused through the industry due to the potentially temporary nature of employment or team membership.

Simple structure (Mintzberg, 1980; 331–332) is generally where the control or leadership resides in either one or only a few people. The simple structure can be highly agile and quickly respond to any changes or opportunities in the market. Usually entrepreneurial in nature, the simple structure may also depend upon the quality of leadership decisions for success.

2.3. Designing an Integrated Organizational Learning Model

The challenge as noted by Nonaka et al. and Lam are focused on how specific individual’s knowledge then becomes part of the enterprise knowledge and is then implemented across the firm to provide the maximum benefit, thus, strategic competitive advantage to the firm.

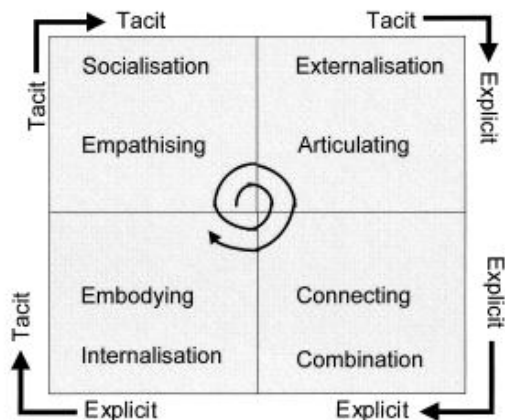


Figure 1 Nonaka et al. (2000b, p. 10)

Nonaka et al.’s (2000a: 12) SECI learning framework and “middle-up-down” management (1994: 29) and examination of the “J-Form” organization accentuates the transfer of tacit knowledge sharing and the inclusion of employees in the innovation process by allowing cross-disciplinary responsibilities

or job rotation that allow the employee to learn more about the overall process used by the company or division, and then through socialization, externalization, and combination create organizational knowledge, and then externalize the knowledge to the firm's culture to formalize and implement the change into the processes or structure of the firm, making such knowledge explicit. Nonaka et al.'s (2000b: 10) model is shown in the Figure 1 and also includes descriptors of knowledge transfer or learning in each quadrant.

In the organizational learning literature, there is the Community/ies of Practice school of thought that considers how groups or classes of workers perform their job and interact with others doing the same job or where they cross boundaries with those who have difference responsibilities or expertise, and how the group(s) then learn and innovate within their milieu. Brown and Duguid (1991) expended upon Lave and Wenger's seminal 1991 paper "Situational Learning: Legitimate Peripheral Learning" to examine the differences between formal training/learning; what they called "canonical practice", and the on the job training (OJT) by experiential learning; "non-canonical practice." They also set forth their perceived requirements and precursors for innovation within a community of practice and the corporate environment that community has to perform within. Brown and Duguid (1991: 41-47) outlined that formal guidelines, requirements, and procedures to carry out a job have to be balanced with the experience of not only learning from those who are already doing the particular job, but actors also have to be able to communicate and learn through observation of the task being completed, of listening to other's experiences and stories of past situations; what they called "war stories," and also have a collaborative aspect of the completion of the work tasks. Brown and Duguid (1991: 50-51) also addressed the pitfalls within a corporate structure that could curtail the effective dissemination of information gleaned from community member's experiences due to the perception that information sharing that is *ultra vires* to their specific duties is counterproductive. Within the next portions of this paper, the models and frameworks are all shown to require, at some level, a community of practice viewpoint within the sharing of both tacit and explicit knowledge.

Nonaka et al.'s later work focuses on the environment, or "Ba." The notion of "Ba" is similar to the "Communities of Practice" put forth by Brown and Duguid (1991: 47), and Ba is less concerned with stopping at the learning of specific embedded tacit industry knowledge. Ba is considered the environment that can be the shared context for knowledge creation within a firm. The space does not have to be physical, but shared experiences, communications, and interactions have to be able to be shared amongst the community. Ba is an evolving loose physical, mental, or virtual boundary that allows the socialization and externalization of knowledge within the firm milieu which can lead to innovations by cross-pollination between actors or even groups within the

space. Building upon the earlier work, Nonaka et al. (2000a) show the cyclical nature of knowledge creation, sharing, and learning that then continue the continuous improvement model where organizational learning not only continues, but flourishes through an atmosphere of corporate sustainability in the face of competition. Attributed to the Lean Production or J-Form organization, Nonaka's model supports the incremental improvement that stable industries require for survival in their markets.

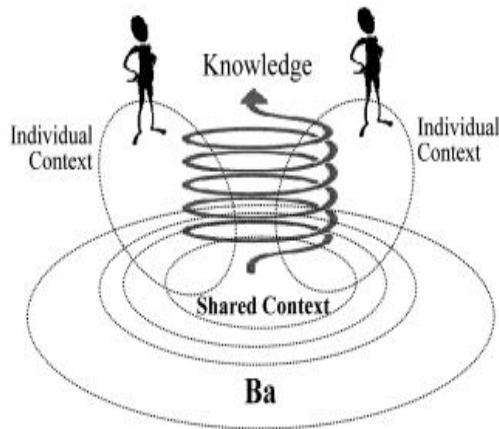


Figure 2 “Ba as Shared Context in Motion,” Nonaka et al. (2000a), p. 14

Lam's (2000: 506) model for organizational learning uses what she calls “Four Contrasting ‘Societal’ Models of Knowledge and Learning: The Role of Tacit Knowledge and Innovation.” Using four base knowledge types, Lam builds a three level model aligning the knowledge, learning, and organizational types best reflecting the type of knowledge and learning. The base types of knowledge are:

- Embrained: this knowledge is individual and explicit. Formal, abstract or theoretical knowledge is included in this category. The information is rational, contains universal principals or laws of nature, and is generally attributed high occupational status as seen with professionals such as physicians, lawyers, and engineers (Lam 2000: 492).
- Embodied: Individual and tacit, this knowledge is built by “doing” and is characterized by practical experience. (Lam 2000: 492).
- Embedded: this knowledge is collective and tacit and resides in shared norms and organizational routines (Lam 2000: 493) and is closely associated with Communities of Practice (Brown and Duguid, 1991).
- Encoded: Collective and explicit knowledge, this is information that can be transferred through signs, symbols, and formal learning or formal documentation as is the case with technical or procedural manuals, etc. Lam (2000: 492–493) points out that encoded knowledge has the inherent drawbacks of

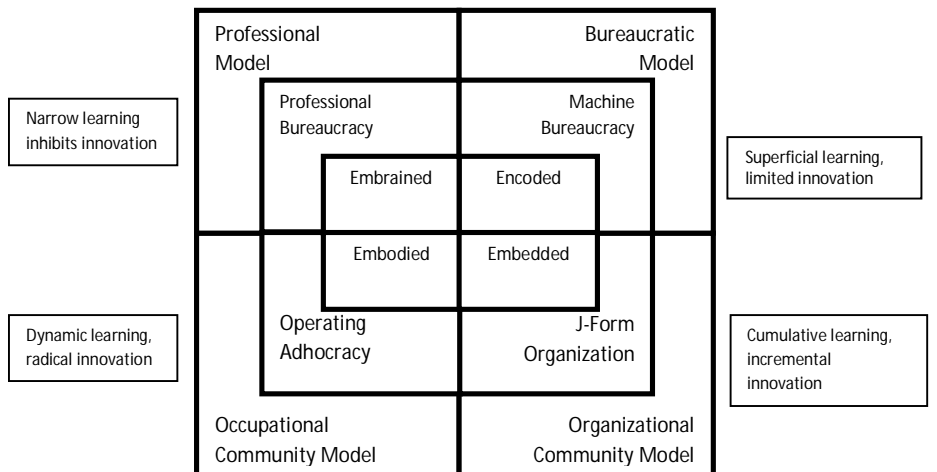
being selective and fails to capture and preserve the tacit skills and judgement of individuals.

Lam (2000: 494) then examines the organizational level of knowledge “control” based upon Mintzberg’s (1980) organizational forms and on her classification (e.g. occupational community and organizational community models.). The professional bureaucracy has a high level of knowledge standardization and individual control and autonomy. High standardization of knowledge with organizational control is attributed to the machine bureaucracy typology. Operating Adhocracies have a low standardization of knowledge and work with individual control. Organizational control with low knowledge standardization is coined as the J-Form organization.

Structures of labor markets as they relate to the individual and the type of work they are suitable; either through formal qualifications or work related experience, are defined by Lam (2000: 500–501) as “occupational labor markets (OLM)” or “internal labor markets (ILM).” The occupational labor market has a high level of job mobility available to those within the market. Formal education and related training are focused on the specific requirements for the industry/firm, or as Lam points out, can be “meta-competencies” encompassing a broad range of knowledge and training that reflect the requirements for the job. This allows inter-firm mobility, similar to Lam’s commentary on Silicon Valley (Lam 2004: 21) and the fluid labor market of highly trained individuals that exhibit high levels of job mobility. The internal labor market (Lam 2000: 504) “are characterized by long-term stable employment with a single employer and career progression through a series of interconnected jobs within a hierarchy.” Here, formal education allows the worker to qualify for a certain job, but then the actual work-related skills are on-the-job and tailored to meet the specific requirements of the firm. Lam (2000: 504) points out two different progression streams: one broad-based where the employee learns a wide array of knowledge to understand the entire enterprise as is the case that Lam states in the J-Form organization. A narrower stream is where hierarchical control and tier boundaries: “siloes” or functional structure may produce copious knowledge on a specific subject, but the overall knowledge and innovation. Whichever stream is present in ILM organizations, Lam (2000: 504) notes the training is very specific and organization-oriented. Lam (2000: 500) notes the following correlation between the degree of formalization and academic biases of education levels and mobility in labor markets: high formal education in the OLM is attributed to the professional model, lower education and training in the OLM is noted as the occupational community model, where high education and training in the ILM is connected to the bureaucratic model, and low education in the ILM is the organizational community (see Figure 3).

Lam (2000: 507–508) posits that the J-Form and Operating Adhocracy are the two most innovative organizational structures. Where the learning is cumulative in the J-Form organization, the organization tends to favor close integration of the overall organizational community through collective knowledge and procedures to create firm-specific proprietary knowledge, thus connecting back to Porter’s Competitive Strategy (Porter, 1980) theories of “Unique Value Proposition” and “Tailored Value Chain” by creating knowledge that market competitors do not have or cost leadership through innovation. J-Forms tend to be very good at incremental innovation, but not as well adapted to radical innovation or change. For radical change, the Operating Adhocracy more suited as it is constituted of a collection of actors within the specific occupational community, where sometimes individuals are added or deleted as the skill-sets are required or not required, and where individual expertise is the foundational element of the enterprise. The potential negative characteristic of the operating adhocracy is that in an occupational community environment, knowledge tends to be held by the individual and therefore not directly “possessed” by the firm, making competitive advantage through proprietary knowledge difficult to control unless legally protected through patents or other instruments.

Figure 3 Knowledge organization and institutions: Three interlocking levels



Source: Lam, A., *Tacit Knowledge, Organizational Learning and Societal Institutions: An Integrated Framework*, 2000, p. 506.

Curado (2006; 13) takes a more management-oriented view of organizational learning and how it fits into the business realm. Curado’s view is that knowledge should be treated as a resource that the firm controls, if not outright owns. That view is further expanded to the position that the firm has to make a

conscious decision regarding the knowledge and organizational learning that they want to create/facilitate/retain to enhance their strategic position and competitive advantage. The view of this framework is that there are two different paths to knowledge acquisition: external and internal. This concept married well with the research that outlines incremental internal innovation as in “J-Form” organizations and potentially in machine bureaucracies. The other is external acquisition, but there is a difference between the methods to externally acquire knowledge. One approach is to purchase it in the form of a takeover or merger of a smaller firm or direct market competitor. The other approach is aligned with the adhocratic approach where those people with the knowledge desired are hired to fulfill certain duties, and therefore can transfer some or much of their knowledge to other team members, and ultimately the organization.

Knowledge acquisition can also be seen as “Exploration,” and the use of the knowledge to execute the work tasks is referred to as “Exploitation” (March, J.G. 1991). New knowledge is created in various ways: research and development, and trial and error. Crossan et al. (2003: 1091) examined a “Feed-forward” and “Feed-back” loop for organizational learning:

- Feed-forward is the exploration per Curado’s theory of learning where the information flows from the individual to the organization to then review and incorporate into the routines and policies and procedures of the organization. This correlates to Nonaka et al.’s “externalizing” and “combining” phases of learning.
- Feed-back is the exploitation of knowledge flowing from the organization to the individual to then apply to the tasks that are required of them to complete. This correlates with Nonaka et al.’s “internalization” and “socialization” phases of learning.

The Nonaka, Lam, and Crossan models are integrated in Figure 4 to show the general literature view of organizational learning and knowledge creation and management. The models do not precisely fit together; but no matter the model, the cyclical nature of the organizational learning framework is ubiquitous in the literature. How the process is explained depends upon the lens or frame of perception and reality that the researcher uses to define their framework structure.

Organizational structures alone cannot induce innovation, no matter how well designed they may be for the market sector and the available labor force. Teece (1998), as cited by Lam (2004: 11), suggests that both internal formal (governance) and informal (cultures and values) as well as the external networks the firm has influence the rate and direction of innovation. The later connects with Porter’s (1980) Five Forces where the relative power of each actor in the supply chain can affect the market performance and profitability

of the firm, and that view can be attributed to internal value chains as well as external ones. Teece (1998), as cited by Lam (2004: 11), also identified two types of innovation: “autonomous” and “systematic.” Autonomous innovation is described as innovation that can be introduced into the market without significant changes to existing firm processes or the associated products. This type of innovation can be aligned with the incremental systematic innovation found in the J-Form or Lean Production where cross-pollination and inputs from “the shop floor” are incorporated to affect positive changes. The “systemic” changes are major innovations that cause major redesign of existing internal processes and changes to various supplier or delivery processes.

Internal culture will affect the efficacy of employees and their openness to working diligently to achieve success. A culture of creativity, appropriate reward, and well designed jobs can foster innovation. Amabile (1998: 79) notes that intrinsic motivation is the key to innovation. Intrinsic motivation comes from within one’s own person and “When people are intrinsically motivated, they engage in their work for the challenge and enjoyment of it. The work itself is motivating.” Those who are extrinsically motivated tend to do things to better their position or pocketbook, or to avoid a certain penalties. Amabile (1998) calls this is the “carrot or stick” approach, but monetary rewards don’t necessarily stop people from performing well, but sometimes doesn’t help the situation either as creative people occasionally feel that their creativity is being bought and thus demotivates them. So, there is that high performers could be so excessively rewarded that the raises cease to motivate.

The different frameworks reviewed in this paper are shown in the integrated model in Figure 4, there is a convergence with the work of Nonaka et al., Lam, and Crossan that takes the base approach of tacit and explicit learning and then shows the process by which it is transformed from one to the other and back within a cyclical framework of organizational learning.

The author posits that a synthesis of the literature review above reveals a number of issues that affect organizational innovation:

- Given the proper conditions, knowledge builds upon itself to create a more refined or elucidated knowledge that can contribute to competitive market advantage for a firm;
- Employees cannot be forced to be motivated, they have to be rewarded appropriately to satisfy their intrinsic or extrinsic motivations to then allow knowledge transfer, and thusly individual and organizational learning to occur;
- Through job satisfaction, creativity can be nurtured;
- Organizational design will dictate whether innovation is easy or difficult.

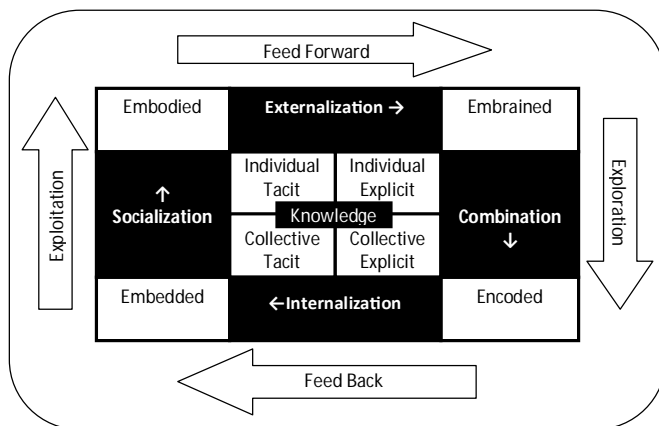


Figure 4 Synthesized Organizational Learning Model

3. Interplay between Forms of Work Organization, Training and Innovation

3.1. Work Forms in the European Context: A Comparative Examination of the EU-27

The European Union conducts research into the differing forms of work organization within member states to understand the framework of the individual economies, and ultimately address member states' economic policies to promote economic expansion by elucidating the differences in work organization and distribution of the organization types across the EU. The two major reports that statistics and findings in this section are the "Work Conditions in the European Union: Work Organization" published by the European Foundation for the Improvement of Living and Working Conditions in 2009, and "Changes in Work in Transformation Economies" published under the auspices of Sixth Framework Programme of the European Union, also in 2009. Additional information has been obtained from the World Bank's Knowledge Indexes program and various Eurostat research papers.

The focus of this section of the paper is the different areas of the EU-27 as although there is a political union of sorts, the constituent parts of the whole are not homogenous. As the baseline of the comparison of work forms within the U-27, Sapir's (2005) approach to groupings is used. Sapir (2005: 7) quantifies four differing social policy models which are, in part, described in the Figure 5:

Figure 5 The Four European Social Policy Models – Protection Against Labor Market Risks for Citizens

Country Groupings	Employment Protection Regulations (EPR)	Unemployment Benefits
Anglo-Saxon (United Kingdom and Ireland)	Low	High
Continental (Germany, Belgium, France, Austria, and Luxembourg)	Medium	High (Generous)
Mediterranean (Greece, Italy, Spain, and Portugal)	High	Low
Nordic (Sweden, Denmark, Finland, plus the Netherlands)	Low	High (Generous)

In addition to the Labor Market Risks for Citizens, Sapir examined the Poverty rates versus employment rates, and an over-arching equity versus efficiency analysis that reinforced the groupings as related to their social policy approaches. Missing from Sapir’s typology are the Post-Socialist countries (Estonia, Latvia, Lithuania, Poland, Hungary, Czech Republic, Slovakia, Slovenia, Bulgaria, and Romania), and as such, are included as one group, although it can be argued within the grouping there are considerable differences, just as within Europe as a whole, but for the purposes of this paper, the groupings follow Sapir’s work with Post-Socialist countries as a separate group.

In the introduction section of this paper, it was noted that the Resource based View (RBV) contends that a company’s success depends upon its possession and development of unique resources. Porter’s Competitive Strategy (Porter, 1980) examines the “Unique Value Proposition,” “Tailored Value Chain,” and “Continuity of Time:” all have direct connections to the continuous process of organizational learning in ensuring the survival of the firm.

The focus of this section of the paper is the European framework of work organization and to address potential connections of the forms of work and organizational between the new member states. Information has been garnered from The World Bank, the European Union (EU), and the European statistics agency, Eurostat.

The first section of this paper outlined some of the differing organization learning types that have been identified in various sectors of the academy, and how organizational learning occurs within the different forms of work organization. “Working Conditions in the European Union: Work Organization” (Valerye et al., 2009: 12–14) identified four basic organizational classes of non-agricultural market sectors established by examining a number of job characteristic variables and grouping methods that established a spectrum of four types of organizations:

- **Discretionary Learning:** Characterized by high levels of autonomy in the work flow, learning, task complexity, and problem solving. It also has low occurrences of monotony, work pace constraints, and repetitiveness. According to Valerye et al. (2009: 12), this tends to be most present in “the work environment of senior managers, professionals, technicians, and services and sales workers.” This work form can be aligned with Mintzberg’s Adhocratic structure where individuals have a high degree of professional freedom to choose the means and methods that will satisfy the requirements of specific tasks or outputs.
- **Lean production:** Attributes of Lean Production include job rotation, teamwork; autonomous and otherwise, multi-skilling and a high level of quality management orientation, demand-driven work pace constraints, and employee learning and problem solving. This work form can be aligned with Nonaka et al.’s “J-Form” organizational structure. Valerye et al.’s (2009: 13) Work Forms study identified that only in the Skilled Worker category does this work form have a majority position from their study of European workers.
- **Taylorist forms:** Characterized by high task repetitiveness, a high level of work pace constraints, low levels of autonomy in work, working methods, task complexity, low learning opportunities, and minimal assistance from the corporate structure or co-workers. This work form aligns closely to Mintzberg’s Machine Bureaucracy (1980: 332–336).
- **Simple or Traditional:** Generally non-codified or largely informal in how work is performed Mintzberg (1979) also calls this a “simple organizational structure” where supervision is generally by one person or manager, but is highly adaptable, and teamwork indicators and task rotation indicators score highly in the description according to Valerye et al. (2009: 14). Mintzberg (1980: 331–332) notes that a classic example of this work form is a small entrepreneurial company.

The four organizational work forms in Valerye et al.’s Work Organization research paper span the broad scope of the employment spectrum. Employment positions are generally broken down to the level of education and the type of work that is completed by the individuals in the different classes. The Work Organization study examined the various types of occupations and then correlated them to the four types of work organization, noted in the table in Figure 6.

Figure 6 Work Organizational Classes (EWCS-2005)

Work Organization Classes				
Employment Description	Discretionary Learning	Lean Production	Taylorist	Traditional or Simple
Senior Managers	52.0	37.0	5.6	5.4
Professionals	59.7	26.8	5.2	8.4
Technicians	56.7	23.7	9.6	10.0
Clerical Workers	43.8	20.0	14.2	22.1
Service and Sales Workers	38.9	17.0	12.2	31.9
Skilled Workers	28.9	34.6	28.6	8.0
Machine Operators	15.3	24.8	40.5	19.4
Unskilled Workers	24.4	21.5	27.0	27.0
Average	38.4	25.7	19.5	16.4

Source: Working Conditions in the European Union: Work Organization, Valerye et al., 2009, Table 5, p. 19, European Foundation for the Improvement of Living and Working Conditions.

Using the descriptions of the four types or models of work organization and the Figure 4 above, it is shown that senior managers, professionals, and technicians; those with relative higher levels of education; are generally working within organizations that exhibit traits of individual control of their work environments and conditions in Discretionary Learning organizational forms. As the educational level of the worker decreases, the ability for the individual to have control over the work processes decreases as exhibited in the increasing percentages of Lean and Taylorist organizational forms noted for Skilled Workers and for machine operators. Service workers tend to be concentrated at opposite ends of the scale with discretionary learning and simple management forms. Unskilled workers are almost evenly split amongst the four work classifications.

From the Work Organization Forms study (Valeyre et al., 2009: 22), the Figure 6 was prepared to show the dispersion of the four types of Work Organization in the New Member States (NMS) and the EU27 average. The EU average for Discretionary Learning work forms is higher than the Eastern NMS average, although Estonia, Hungary, Slovenia, Poland, and Latvia are above the EU27 average. Bulgaria has the lowest result for Discretionary Learning forms at 20.6%. Only Slovakia and Hungary have less Lean Production than the EU27 average at 21.0% and 18.2% respectively. Of the ten Eastern NMS states, only four; Estonia, Latvia, Poland, and Slovenia; are below the EU27 average for Taylorist work forms. Estonia at 11.2% of Taylorist work forms within their economy is third lowest in Europe, trailing only Denmark and Sweden for the lowest incidence of this work form. The

Eastern NMS average is slightly higher than the EU27 average for Simple work forms at 18.0% versus 16.4%, with an even split of five countries above and below the average.

Figure 6

Country/Description	Work Organization Classes (%)			
	Discretionary Learning	Lean Production	Taylorist	Traditional or Simple.
EU 27 (total)	36.9	27.4	19.2	16.5
Scandinavian	54.8	24.3	9.9	11.1
Continental	45.1	24.1	16.9	14.0
Anglo-Saxon	35.4	30.8	14.5	19.4
Mediterranean	29.7	28.2	23.4	18.7
Post-Socialist	30.4	29.0	22.6	18.0

Source: Table values directly from “Working Conditions in the European Union: Work Organization”, Table 7, Distribution of work organization classes, by country (%), p. 22; Valerye, A., Lorenz, E., Cartron, D., Csizmadia, P., Gollac, M., Illesy, M., Mako, C., European Foundation for the Improvement of Living and Working Conditions, 2009.

As a grouping, the Scandinavian countries show the widest variation from the EU-27 average for work form distribution amongst the four categories. Scandinavia has more than half of their firms using a discretionary work form approach (54.8) and has the lowest (9.9%) level of Taylorist work forms in the EU. The Scandinavian Discretionary Learning results is also the highest of any work form in any of the country groupings as no other work form dominated the others with more than 50% occurrence. The Continental countries have higher than EU average and the second highest level of Discretionary Learning (45.1%), and lower than EU average results in the Lean Production, Taylorist, and Simple work forms. The Anglo-Saxon countries have higher than EU average Simple (19.4) and Lean Production (30.8) work forms, with the Discretionary Learning result within 1.5% of the EU average. Both the Mediterranean and Post-Socialist country groupings share the same characteristics for work forms and very similar results; the Discretionary Learning and Lean Production are below the EU average, while the Taylorist and Simple work forms are above the EU average; in fact, the results are all within 1% for each work form symbolizing, in some ways, that these economies could be considered very similar in many ways. The Post-Socialist countries had slightly more Discretionary Learning and Lean Production compared to the Mediterranean Countries, and less Taylorist and Simple work forms.

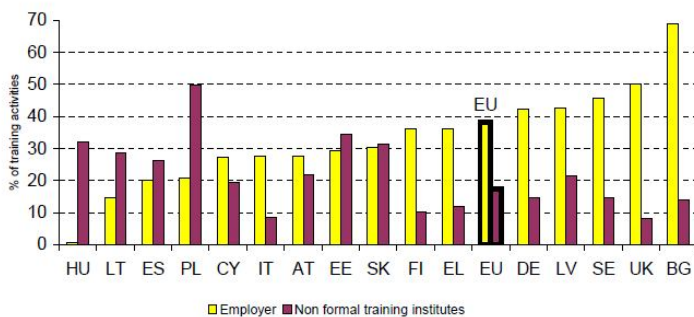
Training or (continued) education is a requirement for effective organizational retention of firm specific knowledge; thus continuing any competitive

advantage. Mako et al. (2013: 9 – in press) stated that “defining innovative capability of the organization, we use the Nielsen (2012:9) definition, according to which, “The capability to innovate is thus an expression of learning process and knowledge production taking place within the firm, in the interplay between different functional groups and various decision levels.”

The results of the Eurostat Adult Learning study (Boateng, 2009: 1) show that approximately one third of EU population between the ages of 25 and 64 years participated in formal or non-formal education or training in the twelve month period preceding the data collection for the study. The importance of continuing education was a pillar of the EU’s Lisbon Strategy for the evolution of the EU towards a dynamic knowledge-based economic area (Boateng, 2009: 2). Within the Lisbon Strategy, education; as an enabler for greater economic growth, was considered to be an important part of a more cohesive and inclusive society for the whole of Europe.

Mako et al. (2011: 64) studied Organizational Innovation and Knowledge Use Practice in the Hungarian and Slovakian service business sector which, in part, examined the use of formal versus experiential learning by “Knowledge Intensive Business Services” (KIBS) firms and found that “Skills development and formal training are important preconditions for innovation.” As stated in this section’s introduction referencing business strategy, organizational learning is key to the creation and retention of proprietary knowledge, and thus, competitive advantage for every organization, turning tacit knowledge to explicit knowledge back to tacit knowledge through training and education as employees, is allowed to refine existing knowledge to innovate within their workplace. Following the academic business strategy literature stream from Penrose through Porter and the Resource-Based View, knowledge should be contained within the firm to ensure competitive advantage. Part of the containment, teaching, formalization, and application for gains or retention of the share of the market sector is the ability to retain the knowledge within the boundaries of the firm and not allow competitors to benefit from proprietary knowledge. Unlike the communities of practice example of Silicon Valley examined by Lam (2004: 21), the high-tech industries in Silicon Valley have a fluid workforce essentially sharing industry knowledge to further the aims of technical excellence and industry-wide commercial success, therefore allowing the entire market workforce to access the fundamental knowledge of the market sector, the national-level training initiatives of individual firms in differing market sectors should be geared to knowledge creation, learning consumption, and application of the outputs by such firms which create the initial and subsequent knowledge to further the individual firm’s market imperatives of profitability and corporate sustainability, thus ensuring their competitive placement in the national or global supply chain.

Figure 7 Training Providers, Firm versus External Provider, Eurostat, 2007



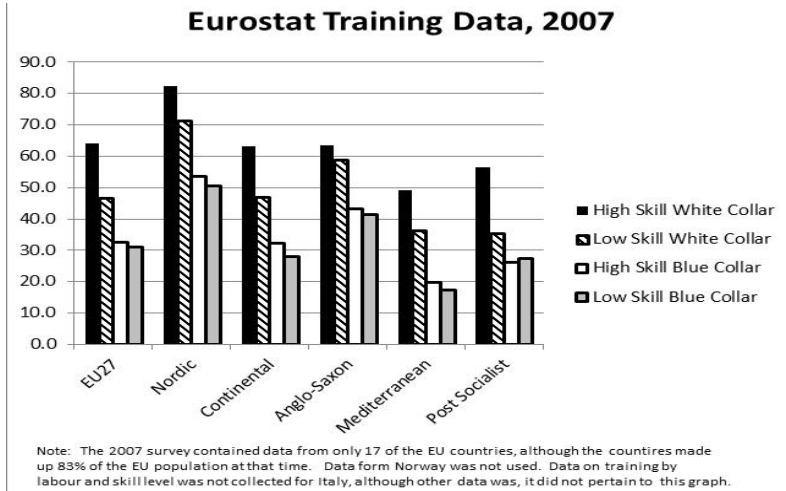
Source: Eurostat, Adult Education Survey

EU average is the weighted average of the 16 EU countries available - Data from France is excluded. No data available for Norway

The question of who provides the training may also influence the types and efficacy of such training when transposed into the corporate performance, although it is very difficult to actually find a way to tie organizational learning to economic performance. As previously mentioned concerning Penrose's and Porter's views that knowledge can be firm-specific, and the resource-based view that knowledge is a firm-owned, therefore proprietary, a commodity, and that the idea of creating, supporting, and enhancing company-specific knowledge that then creates competitive advantage, the providers of education and training may play a paramount role in the determination of a firm to be able to develop and retain market or product-specific knowledge. The Figure 6 shows the results of the Eurostat Education Study (Boateng, 2009: 1) information quantifying those who provide training to workers. The choice of education and training providers across the NMS may be dictated by a number of conditions that are not directly measurable. The support of the respective national government for economic development, the level of skills and presently available in the respective national work forces, the traditional industries within the country, and the level of technology owned or used by individuals may impact where training and education has to be focused.

The four work organization forms are all involved to various degrees of formal and non-formal education and training. The Figure 8 uses information from the European Commission's Eurostat research in Population and Social Conditions' Adult Learning (Boateng, 2009) and combines it with the Working Conditions in the European Union: Work Organization (Valeyre et al., 2009) to show that not all of the EU new member states firm's or organizations are embracing formal and non-formal continuing education to support organizational learning through the development of their workforce's skills and knowledge.

Figure 8 Training and Continuing Education in the EU



The results of the Eurostat study show that those with a higher level of education generally participate in training at a higher level than other employment classes, but there are geographical differences to such participation. The Nordic countries have a very high level of participation amongst the workforce with the lowest category; low skill blue collar workers; with just over half (50.7%) participating in training or continuing education. The Continental countries are similar to the EU average, although the low skill blue collar worker has a lesser result compared to the EU average (28.1% vs. 31.2%). The Anglo-Saxon grouping has higher than EU average training for all groups of workers except high skill white collar workers (63.5%) which is almost the same as the EU average (64%). The Mediterranean group has the lowest overall results of the EU comparatively, and the only higher result than a comparable group is low skill white collar training, which is about 1% higher than the Post-Socialist group. The Post-Socialist group has a higher level of participation in training as a whole compared to the Mediterranean grouping, with low skill blue collar results approximately the same, but the three other groups are more than 5% higher in the later categories. One observation that clearly shows the geographic differences within the EU is that Nordic group has more participation in training and continuing education by low skill blue collar than the Mediterranean group's high skill white collar category. The Eurostat (Boateng 2009: 4) adult continuing education study results also shows that the higher the education level an individual has attained, the higher the amount of formal or non-formal education and training they participate in as adults. It also generally holds that when the dispersion of the work forms closely reflect the EU average, low skilled white collar workers have the second highest results followed by high skilled blue collar workers,

and low skilled blue collar workers have the lowest participation rates for continuing education or training. The only exception to this was the Post-Socialist grouping of countries where the low skill blue collar workers had slightly more training and continuing education (27.4%) compared to the high skill blue collar workers (26.2%).

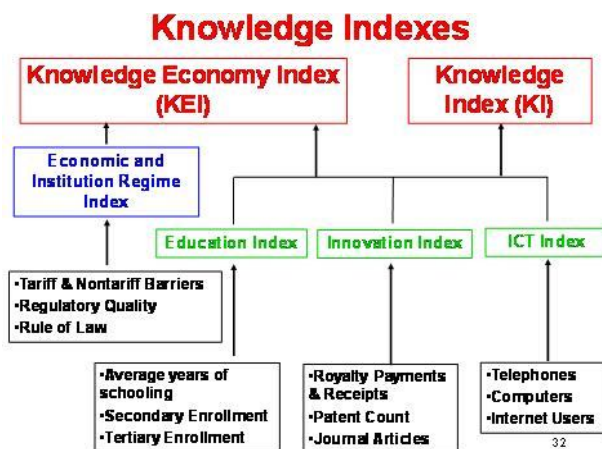
The Eurostat Differences in Adult Learning Survey (Boateng, 2009: 8) shows, in addition to the geographical grouping differences of levels of continuing education and those employment classes which participate in such education, it also shows what organization performs the teaching of the curriculum or provision of training (Figure 7). Should the business strategy literature hold true to the roadmap of business success, it can be presumed that the individual firm should be the primary provider of the knowledge and learning for the workforce it employs, through which the aims of competitive advantage is realized. The results as shown in Figure 7 provide a glimpse of reality that differs from the academic literature. The most striking result is that in some economies, Hungary in particular but also Latvia, Poland, and Estonia, the majority of training is carried out by non-formal training institutes versus training carried out by firms. Bulgaria, with the Taylorist domination of organization work forms, tends to have the employer firms providing training/non-formal education in the majority of instances, to the point of being the highest level of “in-house” training in Europe. At the other end of the spectrum, Hungary has an extremely low level of employer provided training versus an above-average reliance upon exterior training institutes for its workforce.

3.2. World Bank Knowledge Economy Indices: How do Training and Work Forms Influence the Knowledge Economy?

The World Bank tracks many different economic indicators to monitor and report upon individual countries and regions of the world. The Knowledge Indexes produced by the World Bank are split into the Knowledge Index (KI) and the Knowledge Economy Index (KEI).

The KI takes the Education Index, the Innovation Index, and the ICT Index to create a normalized ranking system. The component parts of each index are shown in Figure 9 and outline the high-level indicators that are evaluated to attain the relative index. For example, the Education index is the average level of education attained by the population of the country, the secondary school (High School) enrolment and the tertiary school (University) enrolment. As stated in the Appendix 1, the various index results are compared against the total countries in the grouping, and then the results are compared to the total group. The best 10% are assigned scores that are normalized between 9 and 10, the next class between 8 and 9, and so on.

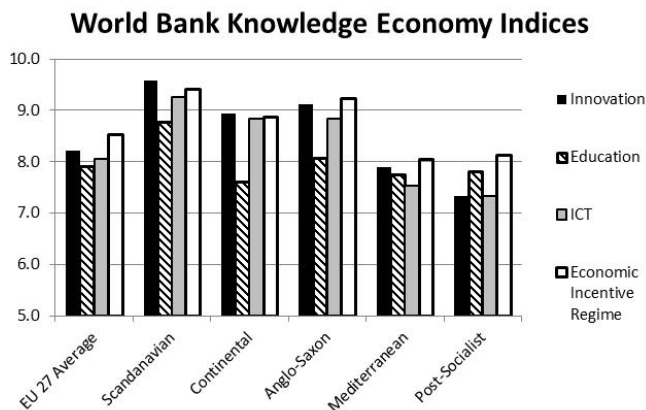
Figure 9 World Bank Knowledge Index Framework



The KEI uses the KI, but then additionally considers the economic and Institution regime Index to obtain an over-all rank. The Figure 9 shows the Knowledge Indexes and a high level list of their evaluative components. The Education Index only uses the completed formal education from primary to tertiary, and does not consider the continuing education that the Eurostat Differences in Adult Learning Survey (2009) explores, but can be considered as showing the relative educational levels of a country’s workforce. There does not appear to be correlation between the level of Innovation nor formal Education that influences the national levels of continuing education and training.

For the purposes of this paper, only the three Indexes that make up the Knowledge Index (KI) are used; the Education Index, the Innovation Index, and the ICT (Information and Communication Technology) Index were compared to the levels of Continuing Education and Training and also the dispersion of work forms to investigate whether there is a connection between the work forms and other indicators. The Discretionary Learning form is often considered to be the most developed work form with the highest level of relative education of employment classes; Senior Managers and Professionals most often associated with the work form, and the lower levels of education generally associated with the Taylorist and Simple (or Traditional) form of work organization. Those countries which show the highest Index results should also show the highest level of participation within Discretionary Learning and Lean Production organizational forms.

Figure 10 World Bank Knowledge Economy Indices Results



The World Bank Knowledge Indices show that the relative rankings of the five country groupings are all above the 70th percentile, or in the upper third of the world’s 146 countries. The Nordic countries are in the highest group, lead by an innovation index of 9.6, ICT result of 9.3, and Economic Incentive Regime index of 9.4, and swept the top four positions in the ranking index. The Anglo-Saxon countries have an Economic Incentive Regime result of 9.2 and an Innovation Index result of 9.1; only the Anglo-Saxon and Nordic groupings have results in the highest bracket. The Continental country grouping is similar to the Anglo-Saxon countries, with the most noticeable difference between the two being the Education Index. The Mediterranean and Post-Socialist groupings are again similar as they were noted to be in the Work Form Dispersion and also the Training Profiles of the country groupings, although the Post-Socialist group has both a lower ICT Index and Innovation Index but both a slightly higher Education Index and Economic Incentive Regime Index result.

As stated in the Introduction to Section 2 when discussing Sapir’s (2005) work, countries within Europe are not homogeneous, nor are countries within the geographic groupings the same. The Figure 11 shows the World Bank Knowledge Economy Index rankings and the relative position of the country within the world’s 146 countries. As stated before, all the European countries are in the top third of the rankings, but there are differences between the countries within the groups. The Nordic grouping is the most homogeneous of all with the four countries being the top four ranked in the index. The Continental grouping has ranges between Germany ranked 8th and Luxembourg 20th, the United Kingdom and Ireland are relatively similar ranked 11th and 14th respectively. The Mediterranean countries range from Spain ranked 21st to Greece ranked 36th. The Post-Socialist countries rankings range from Estonia at 19th to Bulgaria at 45th.

Figure 11 World Bank KEI Rankings

World Bank KEI Ranking out of 146	World Bank KEI Ranking out of 146	World Bank KEI Ranking out of 146	World Bank KEI Ranking out of 146	World Bank KEI Ranking out of 146	World Bank KEI Ranking out of 146	World Bank KEI Ranking out of 146	World Bank KEI Ranking out of 146	World Bank KEI Ranking out of 146	
Nordic Countries	Continental Countries	Anglo-Saxon Countries	Mediterranean Countries	Post-Socialist Countries					
1	Sweden	8	Germany	11	Ireland	21	Spain	19	Estonia
2	Finland	15	Belgium	14	United Kingdom	30	Italy	26	Czech Republic
3	Denmark	17	Austria			31	Malta	27	Hungary
4	Netherlands	20	Luxembourg			34	Portugal	28	Slovenia
		24	France			36	Greece	32	Lithuania
								33	Slovak Republic
								37	Latvia
								38	Poland
								44	Romania
								45	Bulgaria

3.3. Gross Domestic Product: Does Knowledge Economy Have an Effect?

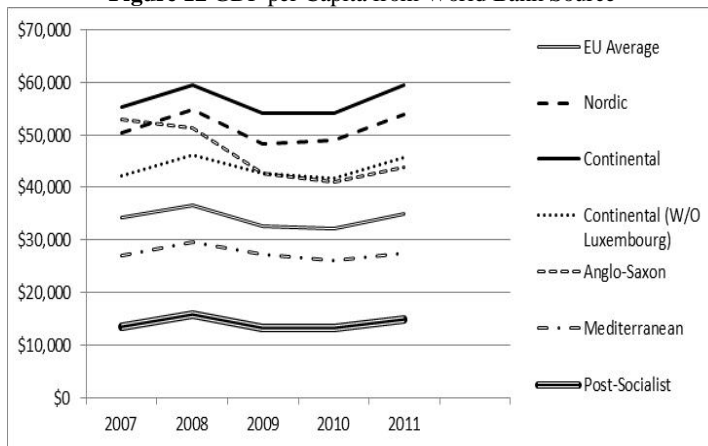
The World Bank rankings discussed in Section 2.2 established a hierarchy of Knowledge Economy development within the EU. Organizational thinking would posit that the higher the Knowledge Economy ranking, the higher the occurrence of “autonomous or semi-autonomous” organizational forms such as Discretionary Learning and Lean Production would flourish, and the higher the level of continuing education and training that workers participate in. Taking this approach may also mean that the combination of Knowledge Economy, advanced work forms, and training and education should result in a higher Gross Domestic Product (GDP) per capita.

The Lisbon Strategy to focus on enabling Europe to evolve into a dynamic knowledge based economic area used continuing education as a pillar of the strategy to fulfill the stated purpose and also to support the creation of a more cohesive and inclusive society for the whole of Europe. Figure 12 shows the Gross Domestic Product (GDP) per capita for each of the country groups. The Continental Grouping is shown twice in the Figure 12; once with Luxembourg included and once without. The reason for this is that Luxembourg, as a small country with a population of under 600,000; has the highest GDP in the world as a hub of activity of world’s financial firms and other financial market-related services. The country does have a broad-based but small economy outside of the financial industry with a mix of agricultural, manufacturing and service industries, thus the author decided that the results would be skewed with the inclusion of Luxembourg, but both conditions are shown in the graph to underline the difference inclusion makes on the results.

Taking the results of the Continental grouping with Luxembourg included into account, the Continental grouping has the highest GDP per capita (shown in \$US) in the EU. Excluding Luxembourg then locates the Continental grouping below the Nordic countries, but above the Anglo-Saxon countries;

although there has been a change of relative position over the five year period examined in this graph where the Anglo-Saxon countries started the time period (2007) very close to the GDP per capita that the Nordic countries achieved, but the GDP has fallen over the five years. The Mediterranean countries are below the EU average, with the Post-Socialist countries at the lowest GDP per capita of Europe.

Figure 12 GDP per Capita from World Bank Source



The results of the GDP compared to the results from the Work Form distribution, the Training and Continuing Education results, and the World Bank’s Knowledge Economy Indices (KI and KEI) would indicate that there may be a correlation between the three elements and economic success; if the work forms are more advanced, with more training and education, and the knowledge economy factors are ranked high, then the GDP will be higher. One possible example of this is the relative third place position of the Anglo-Saxon countries compared to the Continental and Nordic countries, and the relative GDP results. There are other factors to investigate, but these results may supply the basis for future research.

This section of this paper has focused two studies that address organization learning; the European Foundation for the Improvement of Living and Working Condition “Working Conditions in the European Union: Work Organization” from 2009, and the Eurostat Significant Differences in Adult Learning study of 2009. Using the organizational learning model, those within firms are taught the skills that will allow the individuals to execute their responsibilities to satisfy the deliverable requirements, task output, and/or quality requirements that they have been hired to deliver.

In addition, the Knowledge Index has been shown rather than the three constituent parts: Innovation, ICT, and Education, as well as the Knowledge Economy Index (KEI), which uses the KE and then includes the Economic

and Institution and Regime (EIR) Index. The KE description is included in the Appendix 1 of this paper. The EIR Index consists of trade barriers, regulatory quality and rule of law. It is worth noting that all the NMS countries in the group have a KEI higher than the KI, meaning that taking into account that all economic and regulatory issues of the individual states, there are no ethical conditions or contravention of laws in a societal or governmental manner that would negatively impact the conduct of business. It is important to point out that the EU27 average for KEI is below the EU27 average for KI, indicating that there are areas of the “First World” where societal and governance issues remain in “civilized modern societies.”

4. Conclusion and Future Research Questions

4.1. Conclusion

The first section of this paper examined the *organizational learning* literature available in the academy presently. The process of “learning” within an organizational context was examined through the various models that take “hands-on” tacit knowledge and turn it into explicit knowledge, formalize the information into a codified body of knowledge within the firm, and then return it to being applied as tacit knowledge that is then used to complete work tasks for firms to successfully deliver products or services to the market for economic gain. There are many different nomenclatures that describe the way that individuals within firms learn and transmit knowledge to those in the same milieu. Whether it is the Communities of Practice examined by Brown and Duguid (1991), the feed-forward and feed-back loops of Crossan and Lam, the SECI model of Nonaka et al., or the Exploration/Exploitation model examined by Curado, the main result is the circular and, arguably, self-perpetuating knowledge creation and learning model where embedded knowledge is taught, learnt, deciphered, reassembled, and then executed in delivery. Innovation then occurs in a few cases that can support Porter’s competitive advantage of being able to make something or modify an organizational process that competitors cannot imitate. Through the process, the actors in the learning circle play their roles to further the aims of the firm to present the market with products that will allow consumers to exercise their non-satiation imperatives for economic consumption. The business strategy and management academic literature referenced in the Introduction takes organizational learning and examines it as a base for competitive advantage by developing the knowledge-based view of the firm.

Moving to a more strategic view of organizational learning, its foundation is that learning enhances the productivity and, thus, the profitability of a firm.

Should the combined industry sector actors within a country use this approach to enhance their competitive status, the entire sector should benefit. Taken from an industrial sector level to a geographical level, the countries that are home to firms that exhibit proactive training and continuing education should perform better over time, and perhaps better than those country groupings whose industry does not support continued learning and training. This approach can be associated with the Lisbon Strategy to better the economic performance of the EU as a whole and create a more cohesive and inclusive society across Europe. As we have seen, however, the geographical grouping levels of continuing education and training vary widely, and especially in light of the differing social policy approaches outlined by Sapir (2005). The organizational forms show some consistency in results for training levels across organizational forms: the combined higher relative levels of Taylorist and Simple/Traditional organizational forms exhibit lower levels of overall training for all types and skill levels of workers.

As well, within the country groupings that have higher combined Taylorist and Simple work forms; the Mediterranean and Post-Socialist groupings, there is also lower World Bank ICT Index, combined with lower training and continuing education, and then overall lower levels of Innovation Index. No single Index or result appears to be able to predict the relative level of economic success of a region, this is shown by the fact that both the Mediterranean and Post-Socialist groupings have a higher Educational Index result compared to the Continental grouping, yet even without Luxembourg included in the GDP per capita calculation, the Continental grouping significantly outperforms the two lower ranked groupings in all areas examined.

4.2. Future Research Questions

This paper brings up questions that could not be answered using the data sets examined. Potential future research streams for the knowledge economy, organizational learning and innovation focused on the individual countries within the geographical groupings to examine the differences in the results seen at a more macro level may help identify potential correlations and causes for the disparity of economic performance across the EU. Certain historically-influenced conditions, as with the Post-Socialist states, may also bring into the milieu answers to how certain World Bank Index rankings influence Innovation and economic success. Perhaps this stream of potential future research could also then examine the differences found in view of the post-socialist state's former orientation towards collectivism and how that societal imprint is expressed in the current time.

NOTES

1. World Bank, Knowledge for Development (K4D), <http://web.worldbank.org/WBSITE/EXTERNAL/WBI/WBIPROGRAMS/KFDLP/0,,contentMDK:20269026~menuPK:461205~pagePK:64156158~piPK:64152884~theSitePK:461198,00.html#> Knowledge, retrieved December 10, 2012.
2. Government of Ontario, Ministry of Training, Colleges, and Universities, Plumbing Apprenticeship Information, http://www.tcu.gov.on.ca/eng/employmentontario/training/pdf/306A_Eng.pdf, as retrieved on December 11, 2012.

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Appendix 1: Explanation of the World Bank Knowledge Indices Methodology

KEI, KI, Economic Incentive Regime, Innovation, Education, and ICT all taken from the World Bank (2012, and 2013a) "The KAM uses variables that are measured in different units and on different scales. To calculate aggregate knowledge economy indexes, as well as to simplify graphic representation of countries' comparative performance, we bring all the indicators to the same standard of measurement through the process known as normalization. First, countries are ranked in order from "best" to "worst" using their actual scores on each variable. Then, their scores are normalized on a scale of 0 to 10 against all countries in the comparison group. (see the formula below) 10 is the top score for the top performers and 0 the worst for the laggards. The top 10% of performers gets a normalized score between 9 and 10, the second best 10% gets allocated normalized scores between 8 and 9 and so on. In other words, the 0–10 scale ranks the performance of each country on each variable relative to the performance of the other countries in the sample. The following

formula is used in order to normalize the scores for every country on every variable according to their ranking and in relation to the total number of countries in the sample (N_c) with available data: $\text{Normalized (u)} = 10 \cdot (1 - N_h / N_c)$. The KAM Knowledge Index (KI) measures a country's ability to generate, adopt and diffuse knowledge. This is an indication of overall potential of knowledge development in a given country. Methodologically, the KI is the simple average of the the normalized performance scores of a country or region on the key variables in three Knowledge Economy pillars – education and human resources, the innovation system and information and communication technology (ICT). The Knowledge Economy Index (KEI) takes into account whether the environment is conducive for knowledge to be used effectively for economic development. It is an aggregate index that represents the overall level of development of a country or region towards the Knowledge Economy. The KEI is calculated based on the average of the normalized performance scores of a country or region on all 4 pillars related to the knowledge economy – economic incentive and institutional regime, education and human resources, the innovation system and ICT. Refer to graphic chart of Knowledge Indexes from KAM website.”

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