Title: Creativity & Innovation in Europe

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Abstract

Our research has shown there are five major foci which hinder the development of innovative environments within the Eurozone:

- **Research & Development and Firm Practices** fail to carry innovative thought through to the market and firms fail to utilize knowledge sources to close major gaps among Eurozone regions.
- **Policy** fails to support innovative startup firms, instead favoring large established firms.
- **Education** fails to incubate innovative thought.
- **Cultural and Political Aversion to Risk** does not foster an innovative and entrepreneurial environment.
- **Financial Practices** are not unilateral and remain independently structured, nation by nation, but are centrally supported.

Based on the establishment of these five foci and the understanding gained therein, we have developed recommendations concerning each of these factors and conclude that the European Union can succeed in once more becoming an innovative and economic power in the globalized world, but must first overcome significant economic and

cultural hurdles.

I. Introduction and History of European Innovation

Europe has a long history of influential innovation. From Greek mathematics and political thought to the Roman technology-driven domination of the Mediterranean, the foundations of Western Civilization originated in Europe. This was further influenced by the reemergence of scientific thought and engineering innovation during the Renaissance by such minds as da Vinci, Galileo, and Newton. Perhaps the most significant European impact to advent the industrialized world was the Industrial Revolution of the Eighteenth and Nineteenth Centuries. The industrialization of manufacturing and innovation of mechanical processes that occurred during this era ultimately formed the foundation of our industrialized world.

European innovation peaked during the Second World War, as the belligerent nations pushed by the pressures of war developed new technologies. Radar, jet propulsion, communications, and nuclear energy were realized within the scope of two decades. But, post-war Europe, crippled, divided, and drained of its leading innovative minds, left a void quickly filled by the United States' emerging innovative and economic power.

Since the mid-Twentieth Century, Europe has fallen behind other major industrialized powers now emerging. Asian markets and innovation are poised to push Europe even further towards obsolescence. The development of the Europea n Union during the latter half of the Twentieth Century was intended to balance the economic environment of the various member nations, relieve stresses on trade across boarders, and unify the currency creating an economic and financial union known as the Eurozone, in order present a stronger economic face to the world markets.

The European Union (EU), however, has struggled to achieve these goals and instead has plunged into a debt crisis. The

re are several causes for this, but the primary focus of our research was on the political, cultural, and economic barriers to innovation, which itself can be a remedy for the current financial situation and bring the EU up to competitive levels worldwide.

Progress has been made. The European Commission's 2011 "EU Industrial R&D Investment Scoreboard" shows that research and development (R&D) investment by top EU companies recovered strongly in 2010 with a 6.1% rise following a 2.6% decrease in 2009 [10].However, they are lagging behind top U.S. firms and some Asian economies in R&D growth [10].

II. Methodology

Our methodology focused on researching the current state of innovation as well as the causes of the economic crisis to gain a comprehensive and detailed understanding of the underlying circumstances surrounding the Eurozone situation. We used the following approach to reach conclusions on Europe:

1. Brainstorming: To formulate our ideas relevant to European innovation and creativity. Each idea was considered an important factor, and further research was conducted. These various factors were divided among our team members to gather information for data analysis.

    a. Literature Research: Each individual has gathered data for their assigned factor.

    b. Data Analysis: All the information collected in the literature research was analyzed.

    c. Interpretation of Results: We preferred to do qualitative analysis because our research was mostly done on the basis of information gathered from journals, articles, and reports. We used the most current information

available.

III. Current Situation in Europe

The Innovation Union Scoreboard (IUS) 2010 [1] is based on 24 research and innovation-related indicators and is implemented on the 27 current EU Member States. Each indicator is ranked on a scale of zero to one, and the average score from each member state is depicted below. It should be noted that the performance indicated below reflects performance in 2008-2009 due to a lag in the availability of data.

Figure 3.1: EU Member States' Innovation Performance [1]

Based on their average innovation performance across 24 indicators, the Member States were divided into four performance groups: innovation leaders, innovation followers, moderate innovators, and modest innovators. Innovation leaders have a performance of 20% or more above the EU27 average of about 0.50; innovation followers have up to 20% more than but more than 10% below the EU27 average; moderate innovators have 10% to 50% below the EU27 average, and finally, modest innovators are 50% or more below that of the EU 27 average. These break down as follows :

Table 3.1: EU Member State Performance Groups [1]

Innovation leaders	**Innovation followers**	**Moderate innovators**	**Modest innovators**
Denmark	Austria	Czech Republic	Bulgaria
Finland	Belgium	Greece	Latvia
Germany	Cyprus	Hungary	Lithuania
Sweden	Estonia	Italy	Romania

	France	Malta	
	Ireland	Poland	
	Luxembourg	Portugal	
	Netherlands	Slovakia	
	Slovenia	Spain	
	UK		

From their average innovation performance rating, we can see that Sweden and Germany are the highest performing countries in Europe. They, individually, are keeping up with the pace of innovation worldwide. These nations at the top of the ranking scale share a number of strengths in their national research and innovation systems.

On the contrary, nations such as France and Austria are among the Innovation Followers—higher performing nations that do not initiate innovation. According to the Global Innovation Index 2011 [2], we can find that Switzerland, a non-EU Member State, is the overall innovation leader outperforming all Member States of the EU. Switzerland's growth displays an exceptional performance in utilizing intellectual assets and in most economic effects indicators [3].

While there is not one single way to reach top innovation performance, most innovation leaders perform very well in business R&D expenditures and other innovation indicators related to firm activities. Furthermore, the overall performance of the innovation leaders reflects a balanced national research and innovation system.

However, to adequately assess overall performance, we needed to compare EU innovation performance with non-EU countries, both within Europe and abroad (see Figure 3.2 below). "Performance is measured as 100*((X/EU)-1), where X refers to the value for the indicator for the country X and EU to the value for the indicator for the EU27. The values in the graphs should be interpreted as the relative performance compared to that of the EU27. E.g. the US in '2010' is performing 49% better than the EU 27 and China in '2010' is performing 55% worse than the EU27 [1]."

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Figure 3.2: EU 27 Innovation Performance Compared to Main Competitors [1]

According to Figure 3.2, we can see that the United States and Japan are holding a commanding lead over the EU27 as a whole. This result is derived from a performance comparison based on a smaller set of 12 IUS indicators [1]. The same comparison also shows that the EU27 is currently leading ahead of India and Russia, but has been losing its lead over Brazil and China.

We can also examine how the EU nations map out in growth performance in comparison to innovation performance (see Figure 3.3 below). “Color coding matches the groups of countries identified in [Figure 3.1]. The average annual growth rates are calculated over a five-year period. The dotted lines show EU27 performance and growth [1].”

Figure 3.3: Convergence in Innovation Performance [1]

EU innovator nations ranking near the top of the Innovation Performance scale have slower innovation performance growth, with Finland being the fastest growing of the innovation leaders at a rate of 1.6% (see Table 3.2 below). The fastest growing nations are those within the moderate and modest innovators groups with Portugal growing at an average annual rate of 3.5% (see Table 3.2 below). Growth within the EU seems to plateau once innovation reaches a high level.

From this data, we can see that there is a gap between group convergences with the innovation followers growing at a faster rate than the innovation leaders and the moderate innovators growing faster than the innovation followers. The modest innovators, however, grow at a slower rate than the moderate innovators, in particular due to the lagging growth performance of Lithuania.

Table 3.2: EU 27 Innovation Performance Growth Rates [1]

Group	Growth rate	Growth leaders	Moderate growers	Slow growers
Innovation leaders	1.6%	Germany (DE)		Denmark (DK) Sweden (SE)
Innovation followers	2.6%	Slovenia (SI)	Austria (AT) Belgium (BE) Finland (FI) France (FR) Ireland (IE) Luxembourg (LU) Netherlands (NL)	
Moderate innovators	3.5%	Malta (MT) Portugal (PT)	Czech Republic (CZ)	
Modest innovators	3.3%	Bulgaria (BG) Romania (RO)	Latvia (LV)	Lithuania (LT)

According to the IUS report, it should be noted that all 27 Member States have outpaced the U.S. in two key areas: knowledge-intensive services exports and public R&D expenditure [1]. The report points out that the European research system, characterized as being open, with intellectual assets like trademarks and designs are responsible for fuelling the largest growth of the EU-27 innovation indicators.

The biggest gap the EU must deal with is the 'Firm activities' category [4]. Falling short in terms of public-private co-publications and business R&D expenditures, the EU must establish regulatory and other framework conditions that will help bolster private sector investment and enable the business sector to exploit research results effectively.

The latter is particularly important for ensuring an efficient patent system. The EU must also work on bridging the gap that exists in license and patent revenues from abroad [5][6]. The report notes this area is instrumental in fostering changes in an economic system over time, with special emphasis placed on the behavior of businesses, markets, and the general economy.

The European Commission Vice-President and Commissioner for Industry and Entrepreneurship Antonio Tajani has stated that “the Scoreboard shows that [Europe] needs to step up our efforts in making Europe more innovative in order to catch up with our main competitors and recover that path of robust and sustainable growth [7].” VP Tajani stresses the current importance of service innovation for the European economic context and its perspectives in the Expert Panel Proceedings Report [8]. This report pointed out the European countries should aim at strengthening the policy

framework in the following five main areas:

- Raise awareness of the transformative potential of service innovation and its contributions to EU competitiveness;
- Strengthen political leadership at the European, national, and regional levels;
- Build new competitive business from service innovation and improve the agility of policy making to do so;
- Develop dedicated programs in support of innovative services; and
- Promote the application of service innovation to meet societal challenges.

We can see that the current European innovation strategy aims to encourage regional and national innovation policymakers and public support providers to work more closely together in well-defined priority areas such as clusters, services, and eco-innovation and support services provisions.

The main outcomes of this initiative will be to set up an approach for quality labeling of cluster management and to develop training materials in order to help cluster organizations achieve high levels of excellence in their work; to help raise the international profile of a city or region, thus contributing to building a stronger regional innovation identity; to demonstrate how innovation and design responds to societal challenges and to bring different institutions and organizations closer together, and to strengthen the regional innovation systems and the overall commitment toward innovation.

IV. Research and Development in the European Union

R&D plays a significant role in the ability of a company to maintain or enhance their competitiveness in their respective

market(s). Since the financial crisis in 2008, R&D investments dropped by -1.9% in 2009. In the EU specifically, that drop was -2.6%. In 2010, that increased to 4% in the top 1,400 R&D investing companies worldwide (hereafter referred to as Scoreboard companies). For the EU, the increase was by 6.1%. In comparison, the U.S. increased their R&D investment by 10% from 2009. These rises and falls were also seen in net sales of the Scoreboard companies, as illustrated in the figure below. In 2010, net sales in EU companies increased by 13%; the U.S. companies experience a similar increase at 13.2%.

Figure 4.1: Growth of R&D investment and net sales in Scoreboard companies [10]

Of the top 100 R&D investing companies, 29 are based in the EU. Volkswagen (Germany) is the biggest R&D investor; they rank sixth among the Scoreboard companies. Nokia (Finland) is ranked second in the EU, followed by Daimier (Germany); among the Scoreboard companies they rank 11th and 13th respectively. Germany contributes the highest growth of R&D investment in the EU, with France as second, followed by the UK, as shown in the figure below. These three member states hold "[m]ore than two-thirds of the R&D investment of the EU Scoreboard companies . . . [w]ithin the EU group, companies based in the 10 top Member States account for 96.9% of the total R&D investment [10]."

Figure 4.2: R&D investment by the top 1,400 companies by main world regions [10]

R&D Relationships in the European Union

One of the benefits that U.S. innovation has is the relationships among the government, private, and university sectors. With the funding from the government and private sectors, knowledge base from the university sectors, and creativity from the private sectors, these three sectors make a very successful innovation team. These relationships are a lot

stronger in the U.S. than in the EU, which accounts for some of the innovation gap between the two.

In the university sector, that U.S. has had more success in diversifying their financial support from multiple funding sources for R&D, from the federal and state governments, public funding, research grants, donations, royalties, and tuition. In the EU, universities get funding from their respective federal governments in the form of General University Funds (GUF) that “can support departmental R&D programs that are not separately budgeted.” In the U.S., the federal government prefers to “support specific, separately budgeted R&D projects [9].”

As you can see in the following table, the business enterprise sector comprises the majority of overall R&D expenditures in the EU, followed by the higher education then the government sectors. This is the same case for the U.S.

Table 4.1: R&D expenditure as a percentage of GDP (2003-2005) [9]

The following table illustrates that the business enterprise sector is the main source of funding for R&D in the EU (55%). The Lisbon Strategy strives to reach 66% financing by the business enterprise sector in Europe. Some countries have already reached that benchmark: Germany (67%), Luxembourg (80%), and Finland (69%). “The sources of finance are more balanced in the Member States that recently joined the EU (2004 and 2007 enlargements), the Candidate Countries, and Russia. With the exception of the Czech Republic, Latvia, and Slovenia, the government sector’s share is far greater than that of the business sector in these countries. This may be explained by the fact that the government sector was traditionally very strong in these countries and that the business sector still requires time to develop further, in order to be able to invest more funds in R&D [9].”

Table 4.2: Total and business enterprise R&D expenditure by source of funds [9]

In this next table, you can see that the majority of R&D in the EU is invested in natural science, followed by engineering and technology then medical sciences.

Table 4.3: R&D expenditure by field of science in government and higher education sectors [9]

V. Innovation Policy

Innovation policy is a broad concept that contains research and technology policy and overlaps with industrial, environmental, labor, and social policies. In Europe, the functional spectrum and the locations of innovation political systems are spreading. This creates a potential for a more integrated innovation policy within Europe, but also for new internal contradictions [11].

Nowadays, innovation policy in Europe is facing important challenges and decision points. The European Innovation Agenda focuses on some elements in order for Europe to become more innovative. One of these elements is the entrepreneur formation through university and EU entrepreneurship programs [12]. Another element in the EU Innovation Agenda is the risk capital formation and investment. Europe is currently increasing the volume and quality of angel and venture capital investment into startup companies.

The EU Innovation Agenda also focuses on the development of knowledge networks and broker models as a primary mechanism for connecting people across borders in order to support the goal of European integration. At the national level, EU is focusing on technology transfer, intellectual properties, and commercialization at universities and research organizations. University reformation is another important element in the EU Innovation Agenda, but it is applied in few countries. Another element is the infrastructure through building incubators, science and technology parks, and wet

labs.

Despite existing efforts, our research has shown that there are significant elements that are missing in the EU Innovation Agenda. At the forefront of these is Enterprise Innovation. European firms lag U.S. companies in the adoption of information and communications technology (ICT) as a strategic means for productivity improvements. This leads to chronic underperformance in productivity and higher cost structures within firms.

Another element that is missing in the EU Innovation Agenda is the monitoring of outcomes of EU and national innovation programs such as science and technology parks, brokers and knowledge networks, and incubators. A major element that is creating a gap in the EU Innovation Strategy is the absence of commercialization of research outcomes from EU research programs as there is almost no generation of new companies from FP7, or the seventh Framework Program, of the EU for the funding of research and technological development in Europe. In addition, development of innovation competencies such as product design and use of ICT appears to be missing in the EU Innovation Strategy.

There are several structural impediments that hinder Europe's ability to be more innovative. One of these impediments is that Individuals and institutions form small and closed fragmented professional and personal networks. This restricts information sharing, trust building, collaboration, and global vision/impact [13]. Another important impediment is the absence of institutions and processes that promote globalization as Europe has over-reliance on government and a top-down support structure.

In addition, universities in Europe enforce deep divides as they separate business schools from engineering and medical schools. Universities have outdated educational models, and they focus mainly on instructing practice as opposed to researching innovation. Therefore, it is a challenging process to build industry-university collaborations because the industry is interested in research. Absence of key core competencies such as product design and use of ICT is another

important impediment to innovation in Europe.

Moreover, prevalence of family-owned firms in many economies in Europe can be a major issue as families never go public. This means that any new value created is being locked up in those companies and it does not get capitalized or reinvested. Therefore, this inhibits growth and recycling of investment capital into a new generation of startup companies. In general, Europe faces the difficulty of developing new innovation models and institutions due to its fragmented markets and laws. This is the reason why Europe does not have pan-European foundations, innovation incentive awards, and student entrepreneurship societies.

VI. Education in Europe

Education has great influence on the innovation performance of a nation or an economy. Not only does education prepare high-knowledge researchers and highly skilled technical engineers and other such contributors to innovation activities, but a developed educational infrastructure also bolsters support for the institutions involved in the education system. Unilateral education systems that are supported from both government and private sectors offer invaluable resources of knowledge and technology, which industries and companies can associate within their innovation process. The policies surrounding educational system support are also recognized as being relative to entrepreneurship within technology markets [14]. Even within the scope of economic policy, education can be shown to be positively correlated to increases in GDP [15].

The EU invests €2.5 billion each year on education and education-related initiatives constituting roughly 1.8% of EU's total budget [16]. The main framework of this current education strategy was initiated by the Bologna Process in 1999. The goal of this process was to create a European Higher Education system by making more comparable, compatible academic degree standards and quality assurance standards across the borders of the EU’s member states. Subsequen

t meetings of the EU member states' educational councils established several aspects that will initiate a stronger European education [18]:

- Develop a cross-national mobility to make it easier to study in other countries within the EU. This will, in turn, encourage further study or employment across a broader scope. Further, this would encourage more non-European students to study or work in Europe.
- Foster cooperative relationships between education institutions and industry organizations to provide a stable and creative environment to promote internal level of innovation and entrepreneurship.
- Create policy support to improve the efficiency and effectiveness with investment and funding on education.

The primary metric used by the Bologna Process maps how well education encourages innovation. It depends greatly on how large the pool of high-level graduates (those who are considered the source of innovative activities) the current education system can provide [18]. The percentage of graduates from 20 to 29 years old who achieved a tertiary degree in mathematics, science, or technology (MST) were compared to total number of graduates in Europe.

As Figure 6.1 shows, about 0.95 million (1.39% of the total European population) graduates met that metric in 2008. Compared to about 0.69 million in 2000, this is a 37% increase over an 8-year period. But, this growth rate is not evenly distributed among European member states. France, Portugal, and Finland comprise the bulk of MST graduates, while other member states, particularly Luxembourg, Cyprus, Malta, and Hungary comprise a smaller contribution. Compared to other developed countries (see Figure 6.2), the European growth rate is larger, but developing countries with larger populations like China have more rapid growth [18].

Figure 6.1: Number of MST Graduates in Europe [18]

Figure 6.2 Number of MST Graduates in Different Countries [18]

Although the Bologna Process plan has achieved some progress, there are still problems to overcome in the progress, effectiveness and efficiency, and funding of the plan.

Progress of the Plan: The Bologna Plan, enacted in 1999, is under performing [17]. There is an inequity in progress; Finland, Netherlands, and United Kingdom far exceed other nations in building their educational support system. In contrast, Ireland, Flanders, and Italy just begin strategic planning in this area. One particular example is the National University of Ireland,, which has been established for 150 years, but their first strategic planning document was not finished until 2006 [19].

It is apparent that the Bologna Process is more of a structural suggestion than powerful enforcement policy. The chief executive officers within education maintain less power than their counterparts in the U.S. With a hierarchy system in European higher educational systems, the governments still hold great power in the implementation of policy. This places too many obstacles for the education administrations to implement their agendas or develop efficient communication tunnels within education institutions.

Furthermore, chief executive officers within European educational systems are often elected from high-ranking pools of candidates within the system or the governing infrastructure. This is in contrast to the more effective U.S. policies,

where candidates are promoted incrementally from lower ranks. European officials are often disconnected from the departments they are elected to lead, so their expertise and experience are not sufficient to act effectively in their new roles. This lack of internal control within institutions restricts autonomy and limits the ability of these institutions to make proactive plans to improve their performance [20].

Effectiveness and Efficiency of the Plan: As a result of the unequal and under-performing implantation of the Bologna Plan and inherent problems within the educational power structures, the strategic plan of the Bologna Process cannot be applied effectively. Compounding the situation with the current economic recession experienced by the European Economic Zone, the committee has had to attempt to increase the functional performance of education, like energizing economic growth or improving the employment environment, and simultaneously cut the cost of investment. This dilemma has forced compromises in implantation and, in fact, the very outlook of their situation. The extremes of this include redefining the term “employment” to “employability” as employment is no longer guaranteed. Also, their plans are more short-term, problem-solving ones than long-term, overview plans [21].

Although the number of MST graduates has grown 37%, it is uncertain within current research and literature what variables were taken into account. The degree type, the use of the degree to achieve employment, and the growth in the general population are all unaccounted for as far as our research has shown. It is difficult to assess how much the Bologna Process strategies contribute to this growth or if this 37% growth is accounted for by simple population growth, for instance. Metrics do not yet exist to ascertain this.

A further trend needs to be examined. After 2005, the growth rate of European nations has begun to slow, indicating an aging population base. Whether the committee can confront the current demographic decline of students requires further research to verify.

Increasing Funding: Inadequate funding is a serious problem faced by the educational systems of Europe. They must remain competitive with other systems worldwide, but the funding from governments is far less than what is needed to maintain competitiveness. By comparison, U.S. educational institutions have substantial sources of funding coming from private sources, but in Europe, the culture and tax structure do not provide support for this type of activity. Currently, private sources of funding of higher education in the U.S. is six times greater than in Europe [22]. The longstanding European attitude that education should be free for all citizens amplifies the financial problem as private donors are less willing to pay for education in a society that sees education as a government institution.

Despite the growing challenges faced by the European educational systems to remain globally competitive, the current innovative and financial crisis presents both opportunities for creative solutions and severe risks for failing to adapt. Among various strategies, examining current policies by competitive nations (U.S. and Japan for instance) may provide insight into restructuring their own systems, but cultural stigmas and risk aversion must first be solved if Europe is to succeed in achieving competitive levels.

VII. Culture of Risk Aversion

Innovation is not costless. It requires investments whether through money, intelligence, time, or monitoring. However, if appropriately used, innovation may source adequate benefits that will repay all the investment and more. In contrast, risk aversion and protectionism can limit innovation or even kill it in some cases. In the European region, several countries are characterized by a risk-averse corporate culture. In France, for example, there are cultural barriers that limit innovation, specifically the lack of need and reward toward risk taking and entrepreneurship.

While the French government provides several months support for anyone without a job, governmental support is far less when it comes to innovation in academia. This causes skilled researchers to move to other European countries or

to North America where innovation is fostered [23]. Despite being among the innovation leaders, the same institutional and cultural barriers are found in Germany. The fear of risking and failing slows down innovative ideas from emerging into markets.

In early 2007, the Institute for Applied Innovation Studies at the Ruhr University in Bochum released a study on the innovation weakness of German industry. The researchers found that only 13% of new product ideas were brought to market from the only 33% that were prototyped [24].

Figure 7.1: Study done by Ruhr University on outcome of new product ideas

These characteristics can in fact be found across Europe. Hervé Lebret, a Swiss author and engineer, explains that Europe is missing a risk culture, and that it should look into developing an environment of determinism and risk-taking. He also argues the importance of taking risks and how failure is an important element of the learning process. He says that in the United States, failure is viewed as part of learning. Yet in Europe, it is viewed differently; it is stigmatized [25].

This risk averse culture plays an important role in the government decisions toward startups, too. During a conference that transpired in Brussels, Belgium, that included experts on innovation and policymakers, concerns about how well the culture in the public sector would handle innovative projects were expressed. John Connaughton, a UK-based management consultant working on public procurement projects, explained that the process to win government contracts takes a long time, and often those contracts are given to already established firms rather than self-motivated start-ups. "There is a culture of risk aversion, which leads public procurers to play it safe. Innovation is often filtered out at the pre-qualification stage [26]."

In the same Ruhr University study, it was mentioned that the process in deciding whether or not to go on with a project

takes an unnecessary length of time and burden which causes projects to be over-costly and over-engineered by the time they get to the market, and eventually they are deemed not feasible. They also found that companies resist innovation which adds more barriers on innovators to push their ideas [24].

It is noteworthy that the EU Council is focusing on the major societal challenges in their 2020 Research and Innovation Strategy for Europe. This is a critical step that is being taken to improve the consequences of risk aversion in European cultures. In September 2011, the European Commissioner for Research, Innovation and Science, Máire Geoghegan-Quinn, stated at the European Technology Platforms conference in Brussels, Belgium, that she is focusing on creating the conditions for an environment "where innovative firms want to do business, and where talented people want to live and work," [27]. The council is also beginning to recognize the importance of innovation and that it is the key driver of sustainable growth. In another conference in Bilbao, Spain, Spanish Minister of Science and Innovations Cristina Garmendia commented on the significance of science and innovation to keep Europe in a leading position internationally.

VIII. Financial Crisis and Innovation

The European Union represents 7.3% of the world population and has a GDP of $14.82 trillion (2010 EU estimate), making it the largest economy in the world [28]. It is the largest importer and exporter of goods and services, partnering with countries like the U.S., China, and Southeast Asian countries. Europe is also home to 161 of the Fortune 500 companies [29].

The EU monetary zone was established in 1999 among European countries with the "Euro" being launched as the common currency. Initially, 17 countries joined, but within 12 years the number of countries in the Eurozone has reached 27. In a seemingly beneficial move, the EU permitted poorer nations to borrow money at the same low-interest

rates as more developed countries like Germany and France. This has had unintended economic consequences leading to a massive debt crisis as nations borrowed and spent more than they could repay.

Ireland was the first country to bail out its banks in 2010 due to financing the property bubble, which was caused by indiscriminate lending by its three major banks in 2008. Similarly, the government of Portugal encouraged deficit spending and investment bubbles through non-transparent public-private partnerships which resulted in national bankruptcy in 2010. The EU approved a €78 billion bailout package on May 2011. Greece, by far the most economically stressed nation, built up a huge debt after financing a large public welfare program.

Ireland has shown signs of recovery since their 2010 bailout; however, the spendthrift behavior of Greece forced them to seek out for a second bailout. EU imposed 50% "haircuts," which are voluntary debt write-downs by lender countries and International Monetary Fund (IMF) on the face value of their bonds. Still, EU member nations agreed to pay Greece a third bailout of €130 billion in October 2011. Italy is also on the verge of failing as it owes 120% of its GDP in debt. Italy, unfortunately, will be too big for lender nations to bail out.

According to the *Wall Street Journal*, the Eurozone economy could shrink 0.4% in the fourth quarter of 2011. New orders within Germany fell by 4.3% in September [30]. JPMorgan Chase has estimated that Italy, Spain, Belgium, Portugal, and Ireland are likely to miss their deficit target by an average of two percentage points of GDP over 2012-2014 [3]. Eurozone governments are running a budget deficit of 3.2% of GDP [31]. Recent articles on the Eurozone crisis have shown that the borrowing rate for France has also grown; France has long been considered to be one of the lending countries with strong capital.

Most European countries are facing declines in demand and external private funding. Credit shortage is currently limiting financing of innovation and R&D, which in turn has negatively impacted export-oriented manufacturing sectors

and led to a decline in the employment rate. There is also a risk of brain drain for smaller countries if the crisis remains unresolved as leading innovative minds leave struggling, innovation-adverse areas.

Greece, Italy, Spain, and Iceland (Collapsed in 2008) are directly impacted by this financial crisis, and its consequences have been more dire within these nations. Germany, Sweden, the Czech Republic, Denmark, and Bulgaria, in contrast, are in relatively better condition to cope with the financial crisis. Still, other nations have not been impacted by this financial crisis; they are Austria, Croatia, Luxembourg, and Switzerland. The reasons for these nations being unaffected were uncertain within the scope of the research and literature review.

Despite of financial turmoil, countries like Finland, Switzerland, Germany, and Sweden have taken a forward-looking approach and have invested in education and R&D. They have reported a higher investment than in 2009 in their long-term business strategies for innovation [32].

Ernst's and Young's 2011 report on Europe also indicates that [33]:

- Foreign Direct Investments (FDI) projects rose by 14% and 137,337 new jobs were created, which is a 10% increase from 2009
- Europe attracted 3,757 investment projects, a 14% increase from 2009
- 26% of world FDI goes to the EU matching its share of world GDP
- Investors perceive Europe as the second most attractive investment destination after China
- According to 82% of investors, talent is Europe's world class feature

Figure 8.1 Top 15 European countries for FDI [33]

The details show that the Eurozone's balance in trading goods with the rest of the world pushed into surplus in September as exports grew, at a time when other parts of the Eurozone economy are not doing as well amid the deepening sovereign debt crisis [34]. The total trade between the months of January and September was 14% higher than in 2010. Concerning the total trade of Member States, the largest surplus was observed in Germany (+€100.6 billion in January-August 2011), followed by the Netherlands (+€28.8 billion) and Ireland (+€28.2 billion). The United Kingdom (-€76.3 billion) registered the largest deficit, followed by France (-€58.0 billion), Spain (-€31.5 billion), Italy (-€23.4 billion), Greece (-€11.9 billion), and Portugal (-€11.1 billion).

IX. Recommendations:

Our research has shown that the efforts in place to alleviate the current economic and innovative crisis in the Eurozone are not effectively supported or implemented to succeed. Based on the current state of the five foci established herein as **research and development and firm practices**, **policy**, **education, cultural and political aversion to risk,** and **financial practices,** we have formulated a set of recommendations that address each focus and suggest positive steps forward.

I. Research & Development and Firm Practices

Regarding current firm practices, the Eurozone firms should focus activities that expand and utilize available knowledge sources. Firms that are active on markets beyond the national borders generate higher levels of new knowledge that feed into higher productivity. Germany is an example of the successful implantation of this. German

firms that are active on international markets as exporters or foreign direct investors do generate more new knowledge than firms which sell in the national market only. This success is not only due to a larger firm size or more investment in R&D within these firms, but due to the fact that these globally engaged firms learn more from external sources. The importance of these knowledge sources varies with the type of innovation. Furthermore, multinational cooperation in R&D with universities and other research institutes matters in the case of new patents registered, while suppliers are important in the case of the share of new products in total sales and new production processes introduced [1].

Another important recommendation for bridging the economic gaps between regions is to ensure an efficient patent system. To date, Europe is lagging behind the United States, Japan, and other competitors not only in innovation, but also in the costs of patent protection. The actual EU patent system is inefficient; it is more costly than other comparable systems and it creates significant barriers to the diffusion of the innovation in Europe. Therefore, the Europe Patent System should be reevaluated and redesigned to give every potential European inventor the same exact conditions and should not generate cost differentials to firms and inventors located in different countries [2]. Currently, the European Commission is proposing two important legislative proposals which should radically reduce the cost of patents in Europe by up to 80%. This will allow any enterprise to protect their inventions through a single European patent which will be valid in all member states [3].

Regarding the current state of R&D in the Eurozone, we recommend that focus be shifted to important emerging industries, such as the pharmaceutical and biotechnology sectors. Including the technology hardware and equipment and automobiles and parts sectors, they comprise the top three industry sectors in terms of R&D and constitute more than half of R&D investment [10]. Companies in the EU should invest more R&D in those industries to keep a competitive edge in those markets. The following figure depicts the R&D investment of EU and U.S. companies by

industry sectors. These graph illustrates the gaps between the EU and U.S., especially in the high-tech sectors.

Figure 9.1: R&D investment of EU and US companies shares by sector group [10]

Ten of the twenty-seven Member States in the EU comprise 96.9% of the total R&D investment; only 40% of the EU accounts for the majority of R&D in the EU. With innovation in the EU only coming from less than half of the Member States, it would be very beneficial for the EU to look at supporting the growth of innovation and R&D in more Member States.

I. Innovation Policy:

Within the scope of our research into the policy focus, we recommend that the EU reaffirm open investment policies and eliminate restrictions on foreign direct investment. International investments have become an essential element for economic growth. Europe has to start investing internationally in order to develop and introduce new technologies and business methods into the market. This investment brings to an economy good paying jobs, expertise, increased productivity, and a wider range of goods and services at competitive prices [12].

Furthermore, Europe needs to establish an open knowledge environment by collaborating with international institutions and research centers in other successful countries like the United States. This will drive collaboration between and among American and European universities, research institutions, and the private sector. Innovation is increasingly becoming a cross-border and collaborative endeavor; investing in education and research with this international

dimension is more important than ever [12]. For the Transatlantic innovation economy, this means strengthening the existing collaboration between and among American and European universities and research institutions and the private sector.

Market demand for new products and services is clearly the most important factor influencing the level of R&D investment, while market access is the most important factor influencing mobile R&D location decisions [5]. Thus, creating a market friendly to innovation is vital. We recommend that Europe must take steps in order to create the innovation-friendly market.

The first step is to provide a harmonized regulatory environment across the EU favorable to innovation and based on early anticipation of needs. Secondly, using standards-setting powers to demand high technical performance levels and reach agreement on new standards quickly and efficiently. Thirdly, using public procurement to drive demand for innovative goods, while at the same time improving the level of public services. Fourthly, a horizontal factor, fostering a cultural shift which celebrates innovation and a desire to possess innovative goods and experience innovative services, such that Europe develops as a natural home for innovators [5].

I. Education in the European Union

Education as a driver of long-term economic growth and is not be something to be given up. But, in a period of financial crisis, budgets for education are often cut first. While it may be difficult for governments to validate funding, there are still recourses that can be taken to improve the situation. Primarily, we recommend that universities within Europe be given more autonomy to better utilize the funding they have.

Many European universities are controlled by governmental agencies. Giving universities more autonomy would allow

them to streamline their operations and redistribute the funds and other education resources as they see fit. This would allow universities to react rapidly and adapt to the needs of the market, which in turn will increase their ability to produce more technical engineering graduates and research professionals, both key to successful innovative cultures.

Secondly, chief officers of education need to be given more authority to execute. The fact that government agencies still hold great power over university functions means that chief officers have to go through bureaucratic channels to move a university agenda. There is possibility that the agenda will be rejected or will not progress through to implementation. Even if the agenda is approved successfully, the time elapsed for acceptance reduces their efficiency and effectiveness. Allowing executive officers to execute plans efficiently would increase the effectiveness of the universities to adapt to external pressures (markets, industries, etc.).

Finally, we recommend that the current funding system be modified and policies developed to allow educational institutions to raise more funds from private sources. Private funding is an important source of educational investment, but Europe is weak in this area compared to other innovative nations. Europe should encourage private investing into education via promoting the private value of education and the importance of education to creating an innovative culture

I. Risk Aversion

In terms of the European risk adverse culture, the EU should look into supporting startups. This support can be in many forms. We recommend creating localized agencies that will provide both intellectual and financial support for first-time launches. In cities where innovation is rare, these agencies would be calling for proposals [35]. For example, StartEurope.com is an organization in Vienna that was founded in 2009 by a group of entrepreneurs with technical and

economic backgrounds to “activate and foster entrepreneurial thinking and to bridge the gap between different disciplines [36].” This breaks down into several interrelated aspects:

- *Encourage entrepreneurial thinking:* Organizations such as StartEurope.com not only encourage entrepreneurial thinking, but also support and maintain it by sharing successful stories of innovations and risk-takers. Utilizing these stories can be a tool for motivational and a behavioral change.
- *Creating a need for risk taking and innovation*: Instead of supporting unemployed individuals for months, this support period should be shortened, and the money should go into funding new innovative ideas and entrepreneurs. The EU could look into what other countries are doing, for example the United States, and learn from their experience [35].
- *Providing the backup support and mentoring for failures*: Creating a nationally supporting network of innovators and entrepreneurs would aid the flow and shaping of ideas. This will reduce the amount of failures that are necessary to achieve the learning to succeed.
- Finally, *help companies to think in terms of “functionality rather than product or service procurement* [35]”: Based on the research, companies seem to lack the ability of long-term vision. Assisting them with looking into the functionality would help easing the over-criticized process to support innovation, and therefore motivate innovators.

V. Financial Practices and Crisis

It may be too early to predict the results of the financial crisis, but we can ascertain that the current economic environment is uncertain and all nations involved are interrelated. Due to the level of globalization, the effects will

undoubtedly be much more widely spread and move beyond the borders of the EU. We emphasize urgent need for funding new mechanisms to boost development so that financial turmoil will be mitigated.

Forging innovative partnerships should be formed among strong and weak economies so that each innovation can be recognized. This can help alleviate the current situation within the Eurozone for not only economic and technological improvements but diseases, agriculture, and health considerations. It creates a window of opportunity to come up with better, low-cost solutions which would help both countries with weak economies like Spain, Italy, Greece, and Ireland and strong economies like Germany, Finland, and France.

But most importantly, the EU needs to reassess their economic and political union and begin thinking and acting as a single nation. Unlike the U.S., European countries are not part of a single nation with a unified budget and a labor market tied together by a common language [37]. There is a need to act as single nation to provide stability within the Eurozone They should implement a stronger European Central Bank by giving them more authority for trading in Euro Bonds which would help weaker economies to balance their deficit by borrowing money at lower interest rates and also stabilize the overall Eurozone.

X. Conclusion

Innovation can be defined as converting new knowledge into economic and social benefit. This is the result of complex interactions among multiple actors within a system consisting of an environment (local, national, regional) that contains companies, research institutes, funders, as well as the networks through which all these come into contact. (European Commission “Innovation &Technological Transfer”, October, 2002). In times of economic crisis, resulting environmental and social change challenges us to find new ways of thinking and acting. Creativity and innovation can contribute to progress towards the prosperity of a society, but the society must assume responsibility for the way they are used.

In light of the current economic crisis in the Eurozone, cooperation among businesses, universities, and/or profile institutions in research and development is an increasingly necessary priority and can be reflected and enhanced by the creation of "entrepreneurial universities," or those with the capacity to enact innovative change and bridge the corporate and educational realms within Europe.

Furthermore, EU member states must be prepared to invest, anticipate, and accompany structural changes. This requires in particular a reallocation of resources for education, research in information technology and computer science, the creation of high-level jobs, and economic growth. It is true that the innovation process involves not only the corporate sector but also public authorities at national, regional, and local levels; civil society organizations; unions; and consumers. This expanded partnership will create a climate for innovation in the supply of and demand for new ideas and will spur and attract innovation. Innovation depends on demand from consumers and citizens for new products and services. This mainly involves consumer confidence in these products and services, especially in their security.

Through our research we have established recommendations related to the five primary foci currently affecting the Eurozone's economic and innovative recovery. Should the EU be successful in recognizing these foci and enacting change to alleviate the current state of these factors, the EU will be successful in reaching and maintaining competitive levels in world markets.

The EU has in fact begun the process with the Europe 2020 initiative, in which the EU council has recognized and initiated early steps to address the foci set out in our research. Dependent upon the success of this initiative, the EU may indeed begin to climb out of their current economic recession, but there remains significant barriers to overcome.

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Appendix:

Innovation Performance Indicators:

Main type / innovation dimension / indicator	Data source	Referenceyear(s)
Finance and Support		
1.3.1 Public R&D expenditures as % of GDP	Eurostat	2005 - 2009

FIRM ACTIVITIES		
Firm investments		
2.1.1 Business R&D expenditures as % of GDP	Eurostat	2005 - 2009
2.1.2 Non-R&D innovation expenditures as % of turnover	Eurostat	2004, 2006,2008
Linkages & entrepreneurship		
2.2.1 SMEs innovating in-house as % of SMEs	Eurostat	2004, 2006,2008
2.2.2 Innovative SMEs collaborating with others as % of SMEs 2.2.3	Eurostat	2004, 2006,2008
2.2.3 Public-private co-publications per million population	CWTS /ThomsonReuters	2004 – 2008
Intellectual assets		
2.3.1 PCT patents applications per billion GDP (in PPS€)	Eurostat	2003 – 2007
2.3.2 PCT patent applications in societal challenges per billion GDP (inPPS€) (climate change mitigation; health)	OECD / Eurostat	2003 – 2007
2.3.3 Community trademarks per billion GDP (in PPS€)	OHIM / Eurostat	2005 – 2009
2.3.4 Community designs per billion GDP (in PPS€)	OHIM / Eurostat	2005 – 2009
OUTPUTS		
Innovators		
3.1.1 SMEs introducing product or process innovations as % of SMEs	Eurostat	2004, 2006,2008
3.1.2 SMEs introducing marketing or organisational innovations as %of SMEs	Eurostat	2004, 2006,2008
3.1.3 High-growth innovative firms	N/A N/A	N/A N/A
Economic effects		
3.2.1 Employment in knowledge-intensive activities (manufacturingand services) as % of total employment	Eurostat	2008, 2009
3.2.2 Medium and high-tech product exports as % total productexports	UN / Eurostat	2005 – 2009
3.2.3 Knowledge-intensive services exports as % total service exports	UN / Eurostat	2004 – 2008
3.2.4 Sales of new to market and new to firm innovations as % ofturnover	Eurostat	2004 – 2008
3.2.5 License and patent revenues from abroad as % of GDP	Eurostat	2005 - 2009