Reflections on a study visit to Silicon Valley: What lessons can a South East European Region learn from the San Francisco Bay Area Innovation System?

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Based on a study tour to San Francisco organized by the INNOPOLIS, INTERREG IVC project, an attempt is made to identify the main elements of the Bay Area's innovation system and draw up lessons for regions in the EU and especially the South-Eastern part of the EU. The paper examines the role of the higher education system, the role of culture and the role of the public sector in relation to creation and promotion of innovative entrepreneurship in the area and proceeds to compare them to the region of Central Macedonia in Greece. An attempt is also made to define the main characteristics that make the "Silicon Valley ecosystem" unique and provide useful insights for stakeholders and policy makers in regions with less well developed innovation ecosystems. The question whether the Silicon Valley ecosystem can be duplicated is answered in a negative way, but it is argued that nevertheless valuable conclusions and recommendations valid to any innovation ecosystem may be drawn.

1. Introduction: the SF Bay area and the Thessaloniki Metropolitan area.

The purpose of this paper is to analyze the SF Bay Area and Silicon Valley and arrive to some conclusions that could be of value to a completely different innovation eco-system, that of the Region of Central Macedonia and its capital Thessaloniki. Although the two areas are not comparable by any measure (economic, scientific, level of development etc), it is still useful to consider what are the basic elements that make one of them an "exemplary" case of an innovation enhancing environment and what can the other learn in order to stir its own environment towards more innovative friendly directions. We hope to be able to adapt these lessons to the particular local environment in our region and try to define our own recipe for success. The two areas are briefly presented in the following paragraphs.

1.1. San Francisco, the Bay Area and Silicon Valley

The San Francisco metropolitan area has a population of 4,300,000 people while the Bay Area population is 7,150,000 people (Figure 1). The regional GDP: $487 billion, $68,100 per capita (2009; if the Bay Area was a country it would be the 22nd richest country). The area includes Silicon Valley and poses a unique combination of high tech companies, world leading universities, high-risk financiers, an entrepreneurial spirit and a multi-cultural environment. Silicon Valley exemplifies the Venture Capital culture that accelerates innovation. According to Steve Blank [1] VC finance proliferates from the existence of enabling infrastructure (i.e. the existence of Research Universities, a predicable economic system, a stable legal system and the availability of utilities 24/7) and it is based on a culture

that consists of Risk taking; Entrepreneurial spirit; Outward-Facing Tech Universities and Free flow of People and Information.
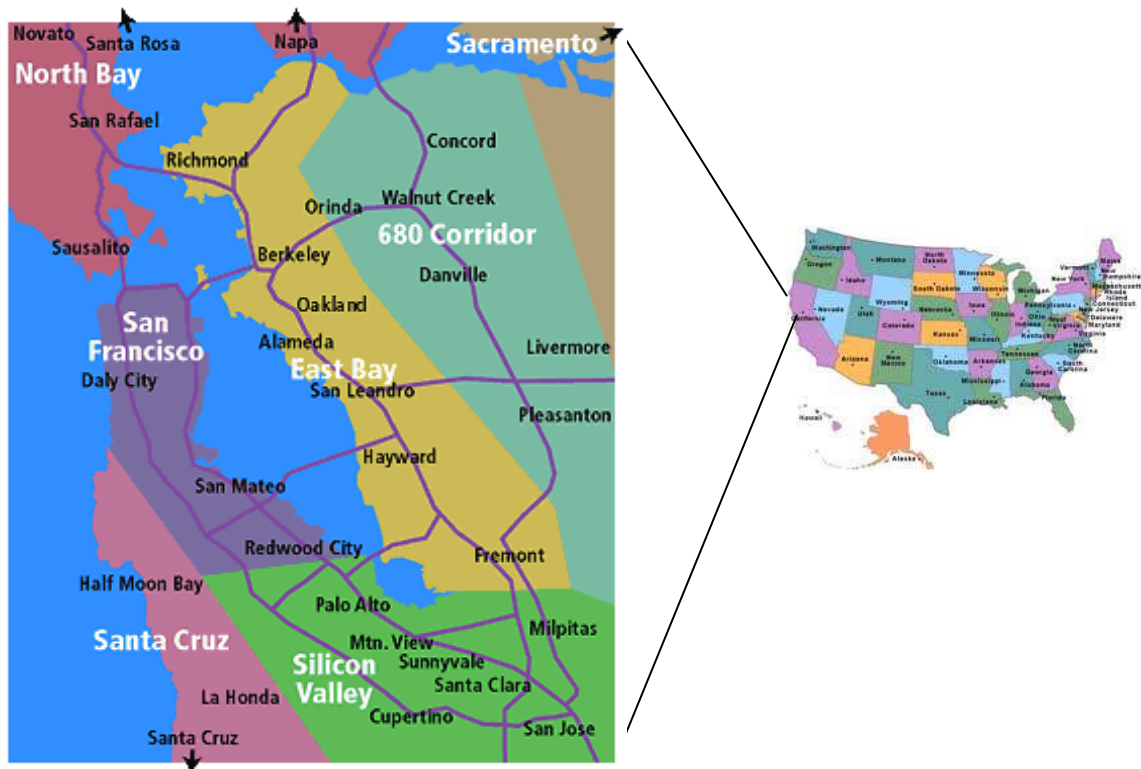

Figure 1 The SF Bay area.

1.2. Thessaloniki metropolitan area and the Region of Central Macedonia

The Thessaloniki Metropolitan area (Figure 2) is the main population, economic and cultural centre of the Region of Central Macedonia. The Thessaloniki metropolitan area population is 1,500,000 people of the 1,900,000 inhabitants of the Region of Central Macedonia. The regional GDP is $39.4 billion (2004), an average $21,038 per capita. It is a typical Southern European region where risk, failure and entrepreneurship are not highly rated in the value system. Its higher education system is rigid and not particularly friendly to entrepreneurship. There is virtually no risk capital available and there are only a limited number of start-ups. The region is suffering from de-industrialization for the last 2 decades. On the other hand the region exhibits a high concentration of higher education and research centers including "islands of excellence"; a long tradition of trade and industry; a unique location (the port, the Balkan hinterland) and a unique combination of history (including multi-cultural heritage), natural environment and mild weather. Thessaloniki and the region of Central Macedonia demonstrates the weaknesses and asymmetries of the Greek innovation system in terms of knowledge creation, diffusion and commercialization as well as the weak links between the elements of its triple – helix (industry, knowledge creating institutions, policy makers). An analytical treatment of the asymmetries in the Greek innovation system is given in [2]. See also the relevant INNO-Policy Trend Chart report [3]. An attempt to define the elements of a innovation strategy for the Thessaloniki metropolitan region is given in [4].
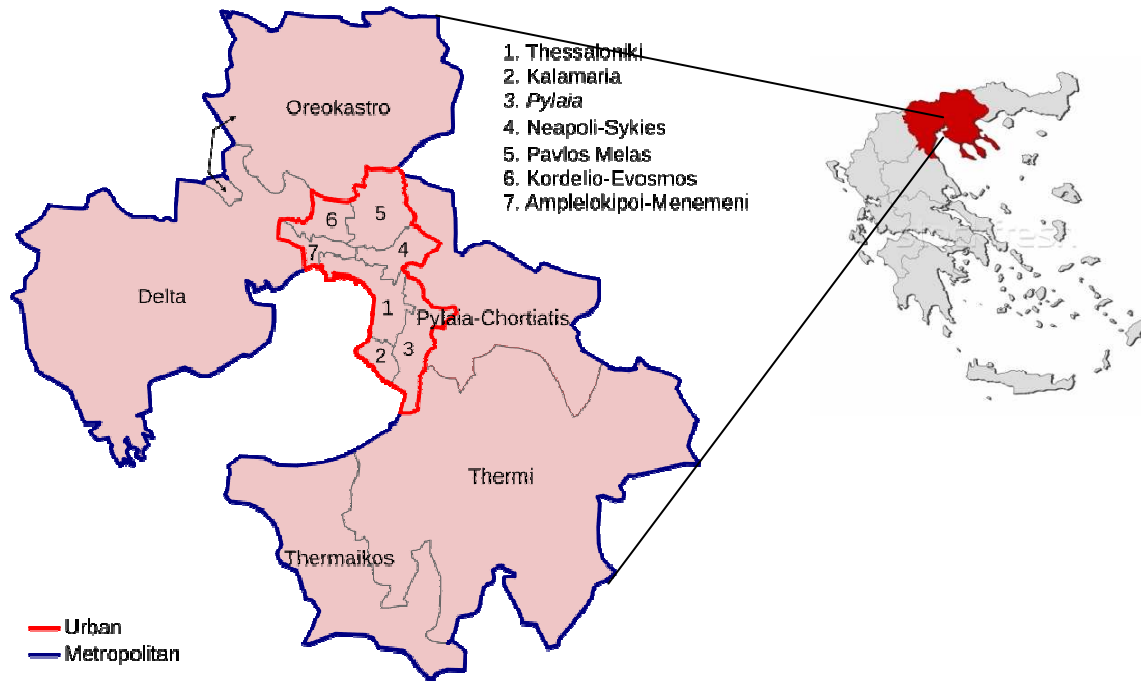
Figure 2 The Thessaloniki Metropolitan area.

2. The SF Bay area study tour

As part of a mission to learn from the experiences of Silicon Valley and the Bay Area on promoting innovation and apply these experiences to their own regions, four teams of policy makers and researchers from Manchester UK, Lodz Poland, Helsinki Finland and Thessaloniki Greece visited the Bay Area on July 2013. The study tour was part of the INNOPOLIS project, a project funded under the INTERREG IVC Program of the European Commision. The INNOPOLIS partners had the chance to visit a variety of institutions and discuss knowledge exchange, technology transfer, the role of the Universities and Research centers as well as the role of the policy makers on supporting new entrepreneurship and innovation. The full list of the organizations visited is given in table 1.

As can be seen by table 1, the study visit included a variety of organizations from every aspect of the triple helix (industry – academia – policy making), public and private including as diverse organizations as the NASA research center (one of the first public investments in the area of the Silicon Valley) and the 6th Str. Revitalization program (a public –private urban development partnership).

Table 1 Organizations visited during the study tour.

Number	Organization	Function
1	**AT&T Labs**	Private research center
2	**University of Stanford**	University
3	**Singularity University**	University
4	**University of California, Berkley**	University
5	**NASA Research Park**	Public research center and co-location area
6	**San Jose State University**	University
7	**US Market Access Centre**	Incubator/ service provider

8	**San Francisco City**	Local Authority
9	**Network for Teaching Entrepreneurship (NFTE) Bay Area**	NGO
10	**Urban solutions: 6th Str. Revitalization program**	NGO
11	**The Hub, Bay Area**	Incubator/ collaboration space
12	**Renaissance Business Center**	Incubator

The next chapter presents as short summary of the profile and the main elements of discussion per organization visited. The two final chapters discuss the lessons learned and overall conclusions of the study tour.

2. Summary of the meetings held during the study tour

2.1 Universities

2.1.1. University of Stanford: EPICENTER

The Mission of the EPICENTER is *"…to unleash the entrepreneurial potential of undergraduate engineering students across the United States to create bold innovators with the knowledge, skills and attitudes to contribute to economic and societal prosperity...".* Their work focuses on Undergraduate Engineering Education with an aim to promote "Entrepreneurship & Innovation" as a core part of Engineering Education. This work is supported by an NSF 5-years grant that responds to the National Priority to change the way engineers are trained nation-wide. It provides incentives & rewards for staff in order to include Entrepreneurship & Innovation in their teaching. EPICENTER works in cooperation with Accreditation Bodies towards policy change in education. A related goal is to reverse the trend of over-specialization in technical disciplines by bringing in humanities into the curriculums. Other incentives of EPICENTER include:

- i-corps program: teaching a class specifically to researchers. Main focus is to teach how to determine the commercial value of NSF funded research.
- Stanford Entrepreneurship Network: 30 entrepreneurship groups within the University. Completely de-centralized. Every week an invited entrepreneur gives a seminar to students and staff.
- Mayfield Fellows Program. A reverse pitching scheme where companies pitch to the best students for internships.

2.1.2. UC Berkley: Center for Information Technology Research in the Interest of Society - CITRIS

UC Berkley is part of the University of California state University system. It has about 280,000 students and an annual budget of $10billion. CITRIS operates as an umbrella organization providing seed capital for faculty to do research projects. It resembles a small (internal) NSF grant. It has 300 affiliated faculty members and it is involved only in projects that faculty can not do on their own or within their own networks. CITRIS focuses on research in the interest of Society: IT for energy; IT for infrastructure; IT for health care. The core of CITRIS research is focusing on Sensors (i.e. Sensors that are energy efficient by Nanotechnology; Sensors on mobile phones for traffic management; Pollution Sensors; sensors for Earthquake monitoring). UC Berkley adopts a different approach than Stanford with regard to entrepreneurship. It focuses on basic research that will, in the long run, create value for the society. For example they estimate that Berkley-originated research created 1/3

of all Biotechnology jobs in the Bay Area and 1/5 of them in the US. Mix of cultures within the University is an important factor for excellence. They try to provide more cost effective education by adopting forms of on-line education and by focusing not only on training students but re-training them after they leave.

2.1.3. Singularity University

Singularity University was founded in 2008 by Drs. Ray Kurzweil and Peter Diamantis with a mission to "…assemble, educate and inspire a new generation of leaders who strive to understand and facilitate the development of exponentially advancing technologies to address humanity's grand challenges…". It is located within the NASA Research Park and benefits greatly from the proximity of other NASA Research Park companies as well as other Paolo Alto based companies. The University is focusing on sectors that present an "Exponential growth pattern". The University offers only post graduate education, i.e.

- A 10 week graduate program with a curriculum that is being reviewed every 6 months and include a mix of Technology Tracks (i.e. Artificial Intelligence & Robotics; Nanotechnology; Networks & Computing Systems; Biotechnology & Bioinformatics; Medicine & Neuroscience), Application Tracks (i.e. Energy & Environmental Systems; Space & Physical Sciences) and Resource/Management Tracks (i.e. Futures Studies & Forecasting; Policy, Law & Ethics; Finance & Entrepreneurship; Design)
- A 7 days executive program. The program concentrates on six exponential growing technologies: Artificial Intelligence & Robotics; Nanotechnology; Biotechnology & Bioinformatics; Medicine & Neuroscience; Networks & Computing Systems; Energy & Environmental Systems.

2.1.4. San Jose State University

San Jose State University is part of California "middle tier" State University system. California State University System has 3 tiers:

- *Upper tier:* Leading Research Universities: the UC system i.e. UCLA, UC Berkley, UC Davies etc
- *Middle tier:* Cal State Universities: i.e. San Jose State University, San Francisco State University. About 25 of them. A total of 420.000 students. SJSU about 20.000 students.
- *Lower tier:* Community Colleges: 2 years of studies. Possibility to transfer to the State Universities after completion of study. Another 500.000 students

SJSU is more a teaching oriented rather than a research-led university. It provides the bulk of the workforce in the Silicon Valley (maybe not the CEOs and the VPs but all the middle management). It is a Community University that works closely with the city, i.e. students work on community projects; library can be used by the city citizens. They emphasise the role of their Alumni by: An on line community of alumni; crowd sourcing for getting funds for start-ups; offering internships; sponsored activities; class visits and guest lecturing.

2.2 Research centers

2.2.1. AT&T Labs

For the last 20 years AT&T Labs is focusing on applied research for the last 20 years while relying on Universities to do the fundamental research and on the Government to fund it. They collaborate mostly with research intense Universities. Their approach is to initiate non-biased research by giving the Universities a problem to solve but no bias on the methodology. Their approach to IP is very flexible. Usually IP is jointly owned with Universities. They collaborate better with Stanford that has an almost frictionless model of cooperation and actively encourages working with industry, than with UC Berkley which they

view as less open to entrepreneurship. In Stafford University they cooperate with the Office of Technology Licensing. A recent AT&T initiative that promotes innovative small firm creation is the establishment of a series of AT&T Foundries which provide a collaborative environment for start ups. AT&T provides space, resources and access to networks. Up till now AT&T has invested a total 80m $ in 3 foundries that have been established in co-operation with technology partners: in Paolo Alto with Erickson, in Dallas with Alcatel and in Tel Aviv with Amdocs.

2.2.2 .NASA Research Park

The Research Park was built on 1939. NASA has invested a total of $18b. They believe and claim that they "kick-started" the Silicon Valley. It operates as a Technology Accelerator. The companies that are established within the Research Park have commercial leases and receive no subsidy or equity form NASA; neither does NASA endorse companies/producers. The value of locating within the Research Park is the opportunity to network and benefit from co-location with other companies and research labs. Currently the park hosts 90 companies on site, from Google to start-ups (including Universities), in diverse sectors such as Biotechnology; Information Technologies; Nanotechnologies.

2.3. Incubators/ accelerators

2.3.1. US MAC (US Market Access Centre)

US Mac is an incubator/ accelerator for foreign companies that want to be established in Silicon Valley. It was founded by San Jose State University on 1995 and operates as a non-for-profit company. It has helped over 900 companies over17 years. Currently 40 companies are hosted in 3 floors in San Jose plus 110 companies in San Francisco. Average stay: 24-30 months. When companies have raised their first investment money they leave the incubator/accelerator. Over 90 volunteers dedicate a minimum of 2 hours per month to support the companies. US Mac is currently preparing to starting a VC fund. They have raised 35m$ with an ultimate goal of 300m$

2.3.2. The HUB, Bay Area

The HUB is a co-working space in downtown San Francisco. It is a part of a global network of 35 locations. The SF one is number 28. They currently have 1300 members and 8 staff members. They support social entrepreneurs, i.e. for profit business that address a social need.

2.3.3. Renaissance Business Center

Renaissance Business Center is a 27 years old NGO. Original funding came from Federal funds, Banks and Corporations. They support under-resourced population towards business creation. Usually they focus on very small businesses (1-5 employees). Most business come to Renaissance when they are at the 3-6 months stage of their operations. Applicants are admitted based on their business plan. Their services include:

- Monthly one-one consultation on marketing, finance etc
- Open books- mutual confidentiality agreement
- Within the 1st year companies usually come up into problems and the incubator tries to help them overcome the "bumps"
- Flexibility: increase/decrease of office space when needed
- The center does not take equity at the businesses

They operate 4 sites in Bay area, in disadvantaged communities in SF, East Palo Alto, and north of Golden Bay Bridge with a total staff of 21 Full Time 3 Part Time. Currently they are hosting about 40 businesses in downtown SF.

2.4. Public Authorities and NGOs

2.4.1. San Francisco City: Mayor's Office of Civic Innovation

The Mayor's Office of Civic Innovation functions as a start up within government. They focus on 3 initiatives:

- *StartupSF* i.e. One-stop shop that helps companies cut through red tape; Portal SF; Tax incentives to start-ups that move to Market str. In downtown SF;

- *EngageSF* i.e Open government, open data from all public organizations so that businesses can develop applications based on the data; Hackathons (i.e. hacker marathons) organized by the City; On-line collaboration platform that lowers the barriers of entry to working with government;

- *SmartSF* i.e. Car2go: car sharing scheme; Living innovation zones: A mechanism that will allow business to demonstrate their products, services and applications using the city as a living lab; Support of Sustainable Social Enterprises.

2.4.2. Network for Teaching Entrepreneurship (NFTE) Bay Area

NFTE is an international NGO that focuses on teaching entrepreneurial skills to kids. It is helping about 50.000 kids 11-18 years old world - wide. They cooperate with the University of San Francisco (USF) which commits that MBA and graduate students work with kids from NEFTE as mentors and coaches. Also USF provides space for NEFTE 1000 kids per year in the Bay Area. Modules of teaching run for 1 semester up to 1 year with a 2 weeks introduction.

2.4.3. Urban solutions: 6th Str. Revitalization program

Urban Solutions is an NGO dedicated in revitalization of urban areas in economic decline. They invested $1.4m public money and leveraged $3.5m private investment in the area of SF 6th street, one of the poorest and deprived areas of the city. Their services include: Sustainability consulting to small businesses; Renovation investment; Small loans to businesses; Help in negotiating leases; organization of Art walks in the City.

3. Key lessons and conclusions

During the study tour a number of key themes were repeatedly discussed and re-surfaced in the meetings that the INNOPOLIS team had with the organizations that were hosting us. We discuss these key themes below; so that we will be able to draw some key lessons that will help us answer three important questions:

- Can the Silicon Valley be replicated?
- What can a South East European Region like Central Macedonia learn from the Silicon Valley?
- How we can use these lessons to define an innovation strategy for our region?

3.1. What makes Silicon Valley unique; what defines the "Silicon Valley spirit"?

The unique combination of high tech companies, world leading universities, high-risk financiers and an entrepreneurial spirit has elevated Silicon Valley to the status of the

proffered destination for students, entrepreneurs and financiers from all over the US and all over the world. The most important elements of the Silicon Valley ecosystem are:

- A culture that welcomes failure: "If you are afraid to fail, you will not try". This in turn encourages experimentation; try, fail and retry.
- A unique educational system that caters for the needs of an ever developing dynamic entrepreneurial community.
- A culture of sharing, giving to the community and engaging that has allowed concepts like social entrepreneurship, voluntary mentorship, crowd-sourcing, crowd-funding and co-location to flourish
- A pioneer spirit combined with a liberal one (the former having its roots to the 1849 gold rush, the later having its roots in the freedom-loving and experimental '60s).
- An inter-disciplinary approach that breaks the barriers between scientific areas and encourages new innovative experimentation

3.2. What is the role of the education system and more specifically of the Universities in the Silicon Valley?

The importance of education and the Universities was repeatedly highlighted. In particular Stanford University is considered by many to be a "catalyst" for Silicon Valley and an institution where businesses and Venture Capitals are looking at closely in order to find their next "big business opportunity" However it is important to note that, in the Bay Area, there is a variety of approaches and ideas on the role of the education and more specifically of the higher education. We believe that this variety is an important ingredient of success:

- There is a variety of approaches on the role of Universities in bringing technological development to the market and society: UC Berkley and Stanford University exemplify two major different approaches. For UC Berkley it is important to focus on basic research, on putting the effort to open new frontiers and educate people and this will "flow back" to society. Stanford on the other hand strongly encourages staff and students to focus on applied research and to bring this research to the society through start-ups and IP exploitation of their own. It is important to note that the two approaches are complementary. It can be safely concluded that while Silicon Valley can not exist without Stanford, it would not be what it is now without UC Berkley either.
- Equally important is the "3 tier" construction of the California public University system. The system is constructed in a way that recognizes the fact that the needs of the society and the market are multi-tier. Businesses do not need only CEOs and VPs (that can come out of institutions like UC Berkeley and Stanford). They also need well educated middle-level management (like those that come out of State Universities like San Jose State University) and well educated and trained technicians and operators (educated in the 2-years public Colleges). The level of commitment and pride that the team experienced while talking to the SJSU staff ("…we educate all the Silicon Valley's middle management…") is nothing but remarkable.
- A third aspect worth mentioning is the considerable effort put by the Universities, we have visited, to exploit alternative ways of providing education that caters to special needs, being it continuous education (UC Berkley, SJSU) on-line education (Stanford, UC Berkley), the development of post-graduate courses focusing on the development of exponentially advancing technologies (Singularity University) or the focus on re-designing and revitalizing engineering education (Stanford). Equally important is the ever-growing trend to offer free on-line material and courses as exemplified by the recent fast development of Mass Open On-line Courses (MOOCs like coursera, udacity and edX).

- The role of "T-shaped education" (2 years more general education plus 2 years specialized education) was exemplified by all the higher level educational institutions that we visited. It is deemed to provide the opportunity to the students to broaden their views and understanding of society before being more focused to their expertise. And this in turn helps inter-disciplinary approaches.
- Finally it is worth mentioning the attention that all four Universities give to the engagement with the community and the importance of bringing in professionals and entrepreneurs in the classroom, so that they can provide first hand real-life experience to the students, thus eliminating the "academia– society" chasm.

3. 3. What (if any) is the role of the public sector in the Silicon Valley?

Although there is an almost universal agreement that the public sector should better not get involved or risk inhibiting innovation and entrepreneurship, there is still enough evidence to support an active public sector involvement that recognizes the role that it can play in supporting:

- Basic research (i.e. the University of California system as exemplified by UC Berkeley)
- A well functioning education system (i.e. the "3 tiers" of the California State Higher Education System)
- Cutting red tape for new enterprise creation and development (i.e. the role of the Mayor's Office of Civic Innovation)
- Offering access to public data in view of creating new innovative services and businesses (i.e. again the SF Mayor's Office of Civic Innovation).

It should be also noted that one of the first big investments in the area (the NASA Research Center) was done by public money. The decisive role of public (and especially military) investment in creating the Silicon Valley is examined in detailed by Steve Blank [1] and emphasized by many scholars of innovation history (see i.e. Henry Chesbrough's analysis of the role that the Office of Scientific Research and Development (OSRD) and Vannevar Bush's "Science, The Endless Frontier" 1945 report played in creating the US and Silicon Valley innovation culture [5]).

3.4 Can the Silicon Valley be replicated?

A lot of efforts to replicate Silicon Valley have failed not only in Europe, but also within the US. The main conclusion of this study tour is that the uniqueness of Silicon Valley and the SF Bay Area lies not on the abundant offer of VC money; nor on the existence of two of the best Universities of the world; nor on the nice climate and location. It is not money, education and climate that mostly define SF Bay Area. It is the culture: the acceptance of failure; the positive attitude; the importance of sharing and openness; the co-existence of different cultures; the role of the community and the desire to give back to the community; the glorification of the pioneer/ entrepreneur; the continuous quest to open new frontiers. This is why Silicon Valley can not be re-created by bringing together a few very good Universities and offering risk capital to businesses and start-ups. The culture needs to be nourished and this takes time and effort directed at the core values of the society.

3.5. What can Thessaloniki and the Region of Central Macedonia learn?

Building an entrepreneurial and innovation-prone culture should be the main focus of the Central Macedonia region. The main lesson is that implementing changes that affect profoundly the core values of the society is not something that can be done overnight and

does not happen with subsidising the high-tech activities of a few firms or by encouraging research and innovation in a few local "centres of excellence". We need to think about how to cultivate a culture that embraces innovation and direct our efforts to the core values of the society. The main elements of such a strategy would be:

- Identifying and building upon the positive elements of the local culture, like the trade and industrial tradition, the willingness of the people to learn and invest in education and the natural advantages of the region.
- Using the concept of Smart Specialization ([6], [7]) to identify and support local strengths and capabilities and streamline public and private investment towards them.
- Promoting entrepreneurial spirit to young generations, by addressing the high school students and providing them with alternative career paths.
- Reforming and invest on education. Redefine the role of higher education so that it serves the purpose of supporting and boosting the local economy. In the California system there is a clear and valuable role for each tier of higher education (upper tier: research driven; middle tier: educating and preparing the middle level management of the Silicon Valley; lower level: provide a basic level of higher education to a large number of people). Additionally the two main research-led institutions have a clear and quite different vision for their role towards research and innovation. These two different visions are complementary and both play a significant role in the local innovation eco-system. We need to re-think Higher Education, continuous education and post-high school education, in order to define clear scope for each one that will serve specific needs and target-groups of the economy and the society. Mobility, competition, excellence, openness and continuous appraisal of the mission and achievements are necessary elements of such a reform.
- Redefine the role of public sector so that it serves entrepreneurship and innovation. Elements of this new role include: Encouragement of Public-Private Partnerships; opening up of public data so that new innovative applications can stem up; encourage entrepreneurship and severely cut red-tape; every public investment in the local innovation system should respect the following principles: accountability, sustainability of results, pursuing of excellence and always assess the impact of each investment, regulation and initiative.

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