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**Governance and Entrepreneurship: The Obama
Administration, Cleantech Startups and ICT; A
Fuzzy-Set/Qualitative Comparative Analysis**

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A Fuzzy-Set/Qualitative Comparative Analysis**

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Abstract

This paper investigates multi-conjunctural causation (and associated governance) patterns of the emergence of clean technology innovation and startups. The theoretical-analytical framework is based on ten (10) themes typology for eco-innovation policy making and evaluation (Kemp, 2011). This framework is further detailed into its sixteen (16) indicative markers concerning emerging and new technologies. These indicative markers are discussed through the details of the Obama Administration’s Startup America Initiative (5 policy areas and 28 policy actions). Accordingly, the framework markers- and the initiative-informed thirty four (34) variables are selected. These variables, as targeted micro-enablers by the initiative, are then used to construct five (5) causal macro-conditions governing the emergence of clean technology innovation and startups. These causal conditions are defined as 1) Governance Institutions, 2) Knowledge Sophistication, 3) Market Configuration, 4) Access to Finance, and 5) Governance ICT. The results of fs/QCA for 38 countries selected from the EU27 and G20 show that the locus of the emergence of clean technology innovation and startups is Knowledge Sophistication. Simply, networks are central, the sophistication of the Knowledge Triangle (Education, Research, Innovation or University, Intermediaries, Industry) is a necessary condition, however, not a sufficient solution in itself, so, incomplete. Market Configuration and Governance Institutions, although they are not that central to the process as Knowledge Sophistication is, these two conditions play a complementary role, according to low levels (or absence), and high levels (or presence) of Access to Finance, respectively; and by coupling with Knowledge Sophistication, the overall solution define the multi-conjunctural causation (and associated governance) pattern of the emergence of clean technology innovation and startups. Therefore, “the Enabler Triangle” (State-Finance-Market), around the Knowledge Triangle (Education, Research, Innovation / University, Intermediaries, Industry) is defined, and it is detected that Governance ICT has embedded features and cultivates both the Enabler Triangle around the locus, and the locus itself, which is the Knowledge Sophistication (the Knowledge Triangle). The associated policy design and action guide is provided.

Keywords: Governance, Entrepreneurship, The Obama Administration’s Startup America Initiative, Clean Technology Innovation, ICT, FS/QCA

JEL: O38, Q58, L26, P52, C02

1. Introduction

This paper investigates the separate and combined influence of the causal conditions which lead to multiple conjunctural causation patterns that lie beneath the emergence of clean technology innovation and startups in various political geographies and economies throughout the world. Once these patterns are identified, designing and implementing a policy and a governance design, a concrete action agenda about green entrepreneurship become a much more evidence-based, well-informed practice.

1.1. Theoretical-Analytical Framework

Paper draws on the theoretical-analytical framework of ten themes for eco-innovation policy (Kemp, 2011). Kemp’s chain-linked and interactive ten themes typology serves as an institutional-evolutionary framework for eco-innovation policy-making and policy evaluation: 1) Identified barriers, 2) Preventing windfall profits, 3) specific versus generic support policies, 4) balance between policy measures and timing, 5) targeted spending in technological areas 6) missions, 7) strategic policy intelligence, 8) portfolios, 9) policy learning, and 10) policy coordination and public-private interactions (for further details please refer to (Kemp, 2011)).

1.2. Ten Themes and Emerging/New Technology Indicative Markers

Concerning emerging/new technologies, the ten themes framework is further detailed into its sixteen (16) indicative markers, all of which are related to one or more themes since the themes are chain-linked and interactive. Table 1 below provides a full overview of the literature behind and empirical review associated.

Table 1 – Ten Themes and Indicative Markers for Emerging/New Technology

| No | Markers for Emerging /New Technology Gov. | Core Shift | Literature | (Kemp , 2011) Theme | Theme Activity (Kemp,2011) | Empirical Base in (Kemp, 2011) |
|----|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Observed Barriers | From market/system failure approach to (emerging) technology-specific barriers | (Remoe, 2008); (Bleischwitz et al., 2009); (Jacobsson and Johnson, 2000); (Hekkert et al., 2007); (Bergek et al., 2008) | 1 | Learning about different types of barriers for different types of innovation | *Euro barometer Survey Eco-Efficient Innovations *Eco-innovation Observatory Benchmark on Eco-innovation Resource Efficiency |
| 2 | Technological Opportunities | From technology foresights to (emerging) technology-specific portfolios | (Jacobsson <i>et al.</i> , 2009); (Edler and Georghiou , 2007); (Ehret and Dignum, 2010) | 8 3 | Formation of adaptive (high and low risk) technology specific portfolios and options | *A portfolio approach by the European Strategic Technology Plan (SET-Plan) |
| 3 | Prioritization and Targeting of Research Areas | From targets to technology-specific R&D / innovation funding gaps | (Newell, 2010); (Gassler et al. 2008); (Edler and Georghiou , 2007); (Ehret and Dignum, 2010) | 5 3 | Analysis of Innovation Funding Gaps acc. to targets | *Energy Technology Perspectives Report by International Energy Agency (IEA) |
| 4 | Good Mix of Policy | From generic/static policy measures to tech-specific, dynamic (timing), regulation/incentive balance in adoption and creation technology | (Kemp, 2000); (Popp, 2006); (Newell, 2010); (Sartorius and Zundel, 2005); (OECD, 2011); (Pontoglio, 2010); (Edler et al, 2007) | 4 | Policy measures analysis for working balance of regulations and incentives | *EU Emissions trading system (ETS) |
| 5 | Ambitious Systemic Targets | From overambitious market share targets to ambitious tech-specific, sub-systemic, sub-targets under new umbrella missions | (Janicke, 2011); (Keith S. ,2008); (Soete and Arundel, 1993); (Edler and Georghiou, 2007); (Ehret and Dignum, 2010) | 6 3 | Economic feasibility and social acceptability of adoption of new technologies | *CO2 Reduction, cases of the Netherlands and the U.K. transport inter-modality |
| 6 | Diversity in Research and Innovation | From technology foresights to (emerging) technology-specific portfolios | (Jacobsson <i>et al.</i> , 2009); (Stirling ,1998) | 8 3 | Formation of adaptive (high and low risk) technology specific portfolios and options | *A portfolio approach by the European Strategic Technology Plan (SET-Plan) |
| 7 | Positive External Economies | From overambitious market share targets to ambitious tech-specific, sub-systemic, sub-targets under new umbrella missions | (Bergek et al, 2008); (Keith S. ,2008); (Soete and Arundel, 1993); (Edler and Georghiou, 2007); (Ehret and Dignum, 2010) | 6 3 | Economic feasibility and social acceptability of adoption of new technologies | *CO2 Reduction, the Netherlands and the U.K. transport inter-modality |
| 8 | Improvement of Innovation System | From state/market dichotomy to multi-level governance | (OECD, 1999); (Braun, 2008); (Borrás, 2009); (Schrama and Sedlacek, 2003); (Kaiser and Prange, 2005); (Dries <i>et al.</i> (2006) | 10 | Horizontal and vertical coordination | *MIP (Milieu-innovatie platform) Flanders Belgium |

| | | | | | | |
|----|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| 9 | Regulatory Barriers in Entry/Exit | From state/market dichotomy to multi-level governance | (Metcalf et al. 1998); (Carlsson et al, 2003) ; (OECD, 1999); (Braun, 2008); (Borrás, 2009); (Schrama and Sedlacek, 2003); (Kaiser and Prange, 2005); Dries <i>et al.</i> (2006) | 10 | Horizontal and vertical coordination | *MIP (Milieu-innovatie platform) Flanders Belgium |
| 10 | Regulatory Capture | From state/market dichotomy to multi-level governance | (Jacobson, Bergek, 2011); (Dries, et al., 2006); (OECD, 1999); (Braun, 2008); (Borrás, 2009); (Schrama and Sedlacek, 2003); (Kaiser and Prange, 2005); Dries <i>et al.</i> (2006) | 10 | Horizontal and vertical policy coordination | *MIP (Milieu-innovatie platform) Flanders Belgium |
| 11 | Policy Adjustment | From generic/static policy transfers to tech-specific /dynamic (timing) regulation/incentive balance in adoption and creation local policies | (Kletzan-Slamanig <i>et al.</i> , 2009); (Nauwelaers and Wintjes, 2008); (Kaiser and Prange, 2005); (Borrás, 2009); (Verbong et.al,2008) | 9 | Analysis of additionality effects / Evaluation of policy mixes | * Environmental Technologies Action Plan (ETAP) |
| 12 | Knowledge Absorption | From closed systems approach to interactive and engaged systems | (Fu et. Al, 2010); (Smits and Kuhlmann, 2004) | 7 | Strategic interaction with different intelligences in sustainability claims/ Benefits for social and technological innovation solutions | * European Road Transport Research Advisory Council (ERTRAC) |
| 13 | Opportunities of Related Variety | From technology foresights to (emerging) technology specific portfolios | (Cooke 2001); (Cooke,2008); (Edler and Georghiou (2007); (Ehret and Dignum, 2010); (Jacobsson <i>et al.</i> , 2009) | 8 3 | Formation of adaptive (high and low risk) technology specific portfolios and options | *A portfolio approach by the European Strategic Technology Plan (SET-Plan) |
| 14 | Socially and Financially Sustainable Policy | From overambitious market share oriented policy to ambitious tech-specific, sub-systemic, sub-targets micro-policies under new umbrella missions | (Kemp, 2000); (Popp, 2006); (Newell, 2010) (OECD, 2011); (Sartorius and Zundel, 2005); (Pontoglio, 2010); (Edler and Georghiou (2007); (Ehret and Dignum, 2010) | 3 4 | Specific and generic policy measures analysis, for working balance of regulations and incentives | *CEP (Public-private partnership), NIP (programme), NOW (organization) in Germany, Fuel Cell Vehicles, Hydrogen Fuel Cell Vehicles Germany |
| 15 | Policy Learning | From generic/static policy transfers to tech-specific , dynamic (timing) regulation/incentive balance in adoption and creation local policies | (Kletzan-Slamanig <i>et al.</i> , 2009); (Nauwelaers and Wintjes, 2008); (Kaiser and Prange, 2005); (Borrás, 2009); (Howlett, 2005) | 9 | Analysis of additionality effects / Evaluation of policy mixes | * Environmental Technologies Action Plan (ETAP) |
| 16 | Policy Signals | From technology-blind fiscal supports to tech-specific startups / SMEs supports | (Brouwer et al., 2002) | 2 | Avoid windfall profits | *Impact Assessment WBSO (Research and Development (Promotion) Act |

2. The Obama Administration’s Startup America Initiative

The Obama Administration’s entrepreneur-focused policy design has been announced on January 31st 2011. Five policy areas of the Startup America Initiative are:

1. *Unlocking access to capital* to fuel startup growth, in terms of expanding access to capital for high-growth startups;
2. *Connecting mentors and education to entrepreneurs*, in terms of expanding entrepreneurship education and mentorship programs that empower entrepreneurs;
3. *Reducing barriers* and making government work for entrepreneurs, in terms of identifying and removing unnecessary regulatory barriers to high-growth startups;
4. *Accelerating innovation* from “lab to market” for breakthrough technologies, in terms of strengthening commercialization of research and development which can generate innovative startups and entirely new industries;
5. *Unleashing market opportunities* in industries like healthcare, *clean energy*, and education, in terms of expanding collaborations between large companies and startups. (Source: <http://www.whitehouse.gov/economy/business/startup-america/progress-report>)

2.1 Policy Areas and Contents

In this section, the five policy areas and associated policy content are given in detail. In total, there are 28 policy headlines are present.

Table 2 - The Obama Administration’s Startup America Initiative (1)

| Policy Areas | Policy Content |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Unlocking Access to Capital | <ol style="list-style-type: none"> 1. Impact Investment Initiative 2. Early-Stage Innovation Initiative 3. Unlocking More Startup Capital 4. Eliminating Capital Gains Taxes on Small Business Investments 5. Simplifying Tax Credits for Investment in Lower-Income Communities |
| 2. Connecting Mentors | <ol style="list-style-type: none"> 6. Connecting Clean Energy Startups with Experienced Mentors 7. Creating New Incubators for Military Veterans Starting High-Growth Businesses 8. Nationwide Center for Teaching Innovation and Entrepreneurship in Engineering 9. Funding Clean Energy Business Competitions for Students Nationwide 10. Advancing Youth Entrepreneurship Education |
| 3. Reducing Barriers | <ol style="list-style-type: none"> 11. Attracting and Retaining Immigrant Entrepreneurs 12. Reducing Student Loan Burdens for Young Entrepreneurs 13. Boosting Access to Seed Grants for Innovative Startups 14. Faster Patent Applications 15. Listening to America’s Entrepreneurs |
| 4. Accelerating Innovation | <ol style="list-style-type: none"> 16. Directed Federal Agencies to Speed Up Research Breakthroughs 17. Created an Innovation Corps to Help Scientists Launch Startups 18. Launched i6 Challenges for Regional Innovation 19. Strengthening High-Growth Clusters through a Jobs and Innovation Accelerator Challenge 20. Funding Innovation Ecosystems for Clean Energy 21. Unlocking Federal Technologies for “America’s Next Top Energy Innovator” 22. Speeding Up Technology Licensing for Biomedical Startups 23. Inventing a New Patent System |
| 5. Unleashing Market Opportunities | <ol style="list-style-type: none"> 24. A Policy Challenge to Accelerate Innovation in Health, Energy, and Education 25. Shrinking Electricity Bills with Open Energy Data 26. Unlocking the Power of Open Education Data 27. Empowering Consumers with Open Health Data 28. Creating a National Platform for Healthcare Innovation |

2.3 Policy Contents and Actions

In this section, related concrete policy actions are listed from official reports and announcements.

Table 3 - The Obama Administration’s Startup America Initiative (2)

| Policy Area / Content | Policy Action |
|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1- Unlocking Access to Capital | |
| Impact Investment Initiative | <i>"The U.S. Small Business Administration (SBA) is committing up to \$1 billion over the next five years, at no new cost to taxpayers, as a match to private-sector funds investing in areas of national priority, including underserved markets and emerging sectors like clean energy and education. The SBA licensed the first Impact Investment Fund in Michigan, providing up to \$130 million in capital to high-growth businesses throughout the state." [1]</i> |
| Early-Stage Innovation Initiative | <i>"The U.S. Small Business Administration (SBA) is committing up to \$1 billion over the next five years, at no new cost to taxpayers, as a match to private-sector investment in early-stage innovative startups – helping them bridge the “valley of death” between seed financing and traditional financing." [2]</i> |
| Unlocking More Startup Capital | <i>"Addressing Congress in September 2011, the President Obama pledged to slash the red tape that prevents too many rapidly growing startup companies from raising capital and going public. The President’s Startup America Legislative Agenda includes responsible bipartisan measures to facilitate access to capital for startups, including creating an “IPO on-ramp” for emerging growth companies, raising the cap on “mini-offerings,” and enabling small-dollar investments through crowd-funding." [3]</i> |
| Eliminating Capital Gains Taxes on Small Business Investments | <i>"The President signed a series of bipartisan bills that eliminated capital gains taxes for certain small business investments held for at least five years – an important incentive to fuel private investment in startups and other small businesses. The President is calling on Congress to make this tax cut permanent." [4]</i> |
| Simplifying Tax Credits for Investment in Lower-Income Communities | <i>"Through reforms to the existing New Markets Tax Credit program, the Treasury Department has committed to making it easier for community development banks to attract private-sector investment in startups and small businesses operating in lower-income communities." [5]</i> |
| 2- Connecting Mentors | |
| Connecting Clean Energy Startups with Experienced Mentors | <i>"The U.S. Small Business Administration (SBA) and the Department of Energy (DOE) launched the Entrepreneurial Mentor Corps program, funding four clean energy business accelerators that together matched experienced mentors to 100 clean energy startups across the country." [6]</i> |
| Creating New Incubators for Military Veterans Starting High-Growth Businesses | <i>"The Department of Veterans Affairs (VA) established two integrated business accelerators focused solely on helping our Veterans launch and sustain their own businesses: Veteran Entrepreneurial Transfer (VETTransfer), a non-profit business incubator providing physical office space and shared services, and the VetSuccess Employment Accelerator (VetSEA), providing a suite of online tools and resources." [7]</i> |
| Nationwide Center for Teaching Innovation and Entrepreneurship in Engineering | <i>"The National Science Foundation (NSF) has awarded a \$10 million grant over five years to launch a national center for teaching innovation and entrepreneurship at the nearly 350 engineering schools throughout the U.S." [8]</i> |
| Funding Clean Energy Business Competitions for Students Nationwide | <i>"To support and empower the next generation of American clean energy entrepreneurs, the Department of Energy (DOE) announced \$2 million to fund the National University Clean Energy Business Challenge, creating a network of regional student-focused clean energy business creation competitions." [9]</i> |
| Advancing Youth Entrepreneurship Education | <i>"The Departments of Education and Labor are advancing a youth entrepreneurship agenda that infuses entrepreneurship education into a range of existing programs. This agenda includes a new National Education Startup Challenge, inviting middle school, high school, and college students to develop an innovative solution to an education problem and prepare a business plan for a new company or non-profit organization to deliver that solution." [10]</i> |
| 3- Reducing Barriers | |
| Attracting and Retaining Immigrant Entrepreneurs | <i>"Because we can’t wait for Congress to enact the President’s blueprint for a 21st century immigration system, the Obama Administration is taking executive action to streamline existing visa pathways for immigrant entrepreneurs, retain more foreign-born science and technology graduates from U.S. universities, facilitate immigration by top researchers, and help U.S. startups and other companies compete for global talent." [11]</i> |
| Reducing Student Loan Burdens for Young Entrepreneurs | <i>"President Obama has announced new executive actions to make it easier for young entrepreneurs and other graduates to manage student loan debt, including a “Pay As You Earn” proposal to let borrowers cap their monthly federal loan payments at 10% of their income, with any remaining debt balance forgiven after 20 years." [12]</i> |
| Boosting Access to Seed Grants for Innovative Startups | <i>"Each year, the federal government provides \$2.5 billion in seed funding for small businesses meeting national research needs, through the Small Business Innovation Research (SBIR) and related programs. President Obama signed legislation that will increase this funding level</i> |

| | |
|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | <i>significantly over the next six years, and the U.S. Small Business Administration has reinvented the SBIR.gov website to help companies' access opportunities across eleven federal agencies."</i> [13] |
| Faster Patent Applications | <i>"The U.S. Patent and Trademark Office (USPTO) is giving innovators more control over the timing of their patent applications, including a new 12-month fast track."</i> [14] |
| Listening to America's Entrepreneurs | <i>"Top Administration leaders hit the road and met with over 1,000 entrepreneurs across the country to identify the most important ways to make government work better for high-growth startups."</i> [15] |
| 4 - Accelerating Innovation | |
| Directed Federal Agencies to Speed Up Research Breakthroughs | <i>"Breakthroughs in science and engineering create foundations for new industries, new companies, and new jobs. The President has directed all federal agencies with research facilities to accelerate the transfer of innovations from "lab to market," marshaling the nearly \$150 billion a year that the federal government invests in research and development."</i> [16] |
| Created an Innovation Corps to Help Scientists Launch Startups | <i>"The National Science Foundation (NSF) has launched the Innovation Corps (I-Corps), a public-private partnership that connects NSF-funded teams of scientists with mentors from the technology, business, and venture capital communities – allowing researchers to transform their work into marketable technologies."</i> [17] |
| Launched i6 Challenges for Regional Innovation | <i>"The Commerce Department's i6 Challenge funds regional collaborations to bring innovative, ground-breaking ideas from the lab to the marketplace, creating new ventures and jobs across the United States."</i> [18] |
| Strengthening High-Growth Clusters through a Jobs and Innovation Accelerator Challenge | <i>"The Department of Commerce, in coordination with sixteen federal agencies, has created the \$33 million Jobs and Innovation Accelerator Challenge, spurring high-tech growth in 20 urban and rural regions around the country."</i> [19] |
| Funding Innovation Ecosystems for Clean Energy | <i>"Through its Innovation Ecosystems Initiative the Department of Energy is funding regional collaborations across the country that accelerates the movement of cutting-edge energy efficiency and renewable energy technologies from university laboratories into the marketplace."</i> [20] |
| Unlocking Federal Technologies for "America's Next Top Energy Innovator" | <i>"America's Next Top Energy Innovator is a program to dramatically reduce the cost and paperwork for startups to license the Department of Energy's 15,000 unlicensed patents, bringing more of these new energy technologies to the U.S. marketplace."</i> [21] |
| Speeding Up Technology Licensing for Biomedical Startups | <i>"The National Institutes of Health (NIH) has developed new streamlined agreements for startups to license federal biomedical inventions. These agreements allow a startup company to take ideas sitting on the shelf, attract additional investments, and turn these inventions into life-saving products."</i> [22] |
| Inventing a New Patent System | <i>"The America Invents Act was passed with President Obama's strong leadership after nearly a decade of effort to reform the Nation's outdated patent laws, helping entrepreneurs and innovators avoid costly delays and unnecessary litigation, and letting them focus instead on innovation and job creation."</i> [23] |
| 5 - Unleashing Market Opportunities | |
| A Policy Challenge to Accelerate Innovation in Health, Energy, and Education | <i>"Through the Startup America Policy Challenge, the White House is asking entrepreneurs and the broader public for ideas on how we can accelerate entrepreneurial innovation in three priority industries: healthcare, clean energy, and education. Students and other solvers then compete to translate the best ideas into "Policy Business Plans," which will be shared with top Administration officials."</i> [24] |
| Shrinking Electricity Bills with Open Energy Data | <i>"Green Button is the common-sense idea that electricity customers should be able to download their own detailed household or commercial electricity usage data from their utility website. Entrepreneurs can then build tools to help consumers conserve energy and save money."</i> [25] |
| Unlocking the Power of Open Education Data | <i>"The Education Data Initiative will harness the power of open data and unleash the creativity and entrepreneurial spirit of educators and innovators all over the country. The Department of Education is allowing students to easily download and share their Federal Student Aid data, and is opening up other data resources to foster new tools for students, parents, and teachers."</i> [26] |
| Empowering Consumers with Open Health Data | <i>"Blue Button provides a secure way for patients to download their health information and share it with health care providers, caregivers, and others they trust. Over 80 million Americans who have health insurance or benefits from the Veterans Administration, Medicare, the Department of Defense, and certain private-sector companies now have access to Blue Button, which promises to fuel innovative new products and services to help Americans manage their health."</i> [27] |
| Creating a National Platform for Healthcare Innovation | <i>"The Administration is encouraging a nationwide series of Innovation Exchanges, where early-stage innovators are matched with major healthcare organizations to pilot new solutions in health information technology (IT)."</i> [28] |

3. Putting them all together

In this section, each policy action, which is in parallel and compatible with the ten themes framework (Kemp, 2011) and the frameworks' indicative markers for emerging and new technologies, is underlined. The policy areas, content and actions are then again well-matched with (these framework markers- and the initiative-informed) micro-conditions, *the targeted enablers by the initiative.*

Table 4 - Putting them all together

| Theme | Emerging /New Tech. | Policy Action | Framework Markers and Initiative-informed Micro-conditions (WEF Codes - Names) |
|--------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Theme 1 - 10 | IM 1-16 | <u>Unlocking Access to Capital</u> "The U.S. Small Business Administration (SBA) is committing up to <u>\$1 billion over the next five years, at no new cost to taxpayers, as a match to private-sector funds investing in areas of national priority, including underserved markets and emerging sectors like clean energy and education. The SBA licensed the first Impact Investment Fund in Michigan, providing up to \$130 million in capital to high-growth businesses throughout the state.</u> " [1] | 7.07 Reliance on professional management 1.05 Irregular Payments and Bribes 8.01 Availability of financial services 8.05 Venture capital availability 10.04 E-participation |
| Theme 1 - 10 | IM 1-16 | "The U.S. Small Business Administration (SBA) is committing up to <u>\$1 billion over the next five years, at no new cost to taxpayers, as a match to private-sector investment in early-stage innovative startups – helping them bridge the “valley of death” between seed financing and traditional financing.</u> " [2] | 7.07 Reliance on professional management 1.05 Irregular Payments and Bribes 8.01 Availability of financial services 8.05 Venture capital availability 10.04 E-participation 8.04 Ease of access to loans |
| Theme 1 - 10 | IM 1-16 | "Addressing Congress in September 2011, the President Obama pledged to slash the red tape that prevents too many rapidly growing startup companies from raising capital and going public. The President's Startup America Legislative Agenda includes responsible bipartisan measures to facilitate access to capital for startups, including creating an "IPO on-ramp" for emerging growth companies, raising the cap on "mini-offerings," and enabling small-dollar investments through crowd-funding." [3] | 1.09 Burden of government regulation 8.03 Financing through local equity market 1.11 Efficiency of legal framework in challenging regulations 1.21 Strength of investor protection 8.06 Soundness of banks 10.04 E-participation |
| Theme 1 - 10 | IM 1-16 | "The President signed a series of bipartisan bills that eliminated capital gains taxes for certain small business investments held for at least five years – an important incentive to fuel private investment in startups and other small businesses. The President is calling on Congress to make this tax cut permanent." [4] | 1.11 Efficiency of legal framework in challenging regulations. 6.04 Extent and effect of taxation 8.06 Soundness of banks 10.04 E-participation Index |
| Theme 1 - 10 | IM 1-16 | "Through reforms to the existing New Markets Tax Credit program, the Treasury Department has committed to making it easier for community development banks to attract private-sector investment in startups and small businesses operating in lower-income communities." [5] | 6.04 Extent and effect of taxation 8.06 Soundness of banks 6.15 Degree of customer orientation 6.16 Buyer sophistication 10.04 E-participation |

| | | | | |
|--------------|---------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | | | |
| | | | Connecting Mentors | |
| Theme 1 - 10 | IM 1-16 | | "The U.S. Small Business Administration (SBA) and the Department of Energy (DOE) launched the Entrepreneurial Mentor Corps program, funding four clean energy business accelerators that together matched experienced mentors to 100 clean energy startups across the country." [6] | 7.07 Reliance on professional management 5.05 Quality of management schools 5.07 Availability of research and training services 10.04 E-Participation |
| Theme 1 - 10 | IM 1-16 | | "The Department of Veterans Affairs (VA) established two integrated business accelerators focused solely on helping our Veterans launch and sustain their own businesses: Veteran Entrepreneurial Transfer (VETransfer), a non-profit business incubator providing physical office space and shared services, and the VetSuccess Employment Accelerator (VetSEA), providing a suite of online tools and resources." [7] | 10.04 E-Participation 8.01 Gov't prioritization of ICT 8.02 Importance of ICT to Gov't vision |
| Theme 1 - 10 | IM 1-16 | | "The National Science Foundation (NSF) has awarded a \$10 million grant over five years to launch a national center for teaching innovation and entrepreneurship at the nearly 350 engineering schools throughout the U.S." [8] | 5.07 Availability of research and training services 12.06 Availability of scientists and engineers 12.02 Quality of scientific research institutions 10.04 E-Participation |
| Theme 1 - 10 | IM 1-16 | | "To support and empower the next generation of American clean energy entrepreneurs, the Department of Energy (DOE) announced \$2 million to fund the National University Clean Energy Business Challenge, creating a network of regional student-focused clean energy business creation competitions." [9] | 5.02 Tertiary education enrollment, gross % 5.04 Quality of math and science education |
| Theme 1 - 10 | IM 1-16 | | "The Departments of Education and Labor are advancing a youth entrepreneurship agenda that infuses entrepreneurship education into a range of existing programs. This agenda includes a new National Education Startup Challenge, inviting middle school, high school, and college students to develop an innovative solution to an education problem and prepare a business plan for a new company or non-profit organization to deliver that solution." [10] | 5.03 Quality of the educational system 5.04 Quality of math and science education |
| | | | Reducing Barriers | |
| Theme 1 - 10 | IM 1-16 | | "Because we can't wait for Congress to enact the President's blueprint for a 21st century immigration system, the Obama Administration is taking executive action to streamline existing visa pathways for immigrant entrepreneurs, retain more foreign-born science and technology graduates from U.S. universities, facilitate immigration by top researchers, and help U.S. startups and other companies compete for global talent." [11] | 1.11 Efficiency of legal framework in challenging regulations. 7.08 Brain drain |
| Theme 1 - 10 | IM 1-16 | | "President Obama has announced new executive actions to make it easier for young entrepreneurs and other graduates to manage student loan debt, including a "Pay As You Earn" proposal to let borrowers cap their monthly federal loan payments at 10% of their income, with any remaining debt balance forgiven after 20 years." [12] | 8.02 Affordability of financial services 8.04 Ease of access to loans 8.06 Soundness of banks 10.04 E-Participation |
| Theme 1 - 10 | IM 1-16 | | "Each year, the federal government provides \$2.5 billion in seed funding for small businesses meeting national research needs, through the Small Business Innovation Research (SBIR) and related programs. President Obama signed legislation that will increase this funding level significantly over the next six years, and the U.S. Small Business Administration has reinvented the SBIR.gov website to help companies' access opportunities across eleven federal agencies." [13] | 1.05 Irregular Payments and Bribes 12.02 Quality of scientific research institutions 9.02 Firm-level technology absorption 11.07 Production process sophistication |

| | | | |
|--------------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Theme 1 - 10 | IM 1-16 | "The U.S. Patent and Trademark Office (USPTO) is giving innovators more control over the timing of their patent applications, including a new 12-month fast track." [14] | 1.02 Intellectual property protection 10.04 E-Participation Index 10.03 ICT use & Gov't efficiency |
| Theme 1 - 10 | IM 1-16 | "Top Administration leaders hit the road and met with over 1,000 entrepreneurs across the country to identify the most important ways to make government work better for high-growth startups." [15] | 1.12 Transparency of government policymaking 1.09 Burden of government regulation 1.11 Efficiency of legal framework in challenging regulations. 10.04 E-Participation Index |
| | | Accelerating Innovation | |
| Theme 1 - 10 | IM 1-16 | "Breakthroughs in science and engineering create foundations for new industries, new companies, and new jobs. The President has directed all federal agencies with research facilities to accelerate the transfer of innovations from "lab to market," marshaling the nearly \$150 billion a year that the federal government invests in research and development." [16] | 1.08 Wastefulness of government spending 12.02 Quality of scientific research institutions 10.04 E-Participation |
| Theme 1 - 10 | IM 1-16 | "The National Science Foundation (NSF) has launched the Innovation Corps (I-Corps), a public-private partnership that connects NSF-funded teams of scientists with mentors from the technology, business, and venture capital communities – allowing researchers to transform their work into marketable technologies." [17] | 12.04 University-industry collaboration in R&D 12.06 Availability of scientists and engineers 12.02 Quality of scientific research institutions 5.07 Availability of research and training services |
| Theme 1 - 10 | IM 1-16 | "The Commerce Department's i6 Challenge funds regional collaborations to bring innovative, ground-breaking ideas from the lab to the marketplace, creating new ventures and jobs across the United States." [18] | 12.04 University-industry collaboration in R&D 11.07 Production process sophistication |
| Theme 1 - 10 | IM 1-16 | "The Department of Commerce, in coordination with sixteen federal agencies, has created the \$33 million Jobs and Innovation Accelerator Challenge, spurring high-tech growth in 20 urban and rural regions around the country." [19] | 12.04 University-industry collaboration in R&D 11.07 Production process sophistication |
| Theme 1 - 10 | IM 1-16 | "Through its Innovation Ecosystems Initiative the Department of Energy is funding regional collaborations across the country that accelerates the movement of cutting-edge energy efficiency and renewable energy technologies from university laboratories into the marketplace." [20] | 12.04 University-industry collaboration in R&D 5.04 Quality of math and science education 11.07 Production process sophistication |
| Theme 1 - 10 | IM 1-16 | "America's Next Top Energy Innovator is a program to dramatically reduce the cost and paperwork for startups to license the Department of Energy's 15,000 unlicensed patents, bringing more of these new energy technologies to the U.S. marketplace." [21] | 6.06 No. procedures to start a business 6.07 No. days to start a business 1.02 Intellectual property protection 10.04 E-Participation 10.03 ICT use & Gov't efficiency 11.07 Production process sophistication 6.01 Intensity of local competition 6.02 Extent of market dominance 9.02 Firm-level technology absorption |
| Theme 1 - 10 | IM 1-16 | "The National Institutes of Health (NIH) has developed new streamlined agreements for startups to license federal biomedical inventions. These agreements allow a startup company to take ideas sitting on the shelf, attract additional investments, and turn these inventions into life-saving products." [22] | 6.06 No. procedures to start a business 6.07 No. days to start a business 1.02 Intellectual property protection 10.04 E-Participation |

| | | | |
|--------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Theme 1 - 10 | IM 1-16 | <p>"The America Invents Act was passed with President Obama's strong leadership after nearly a decade of effort to reform the Nation's outdated patent laws, helping entrepreneurs and innovators avoid costly delays and unnecessary litigation, and letting them focus instead on innovation and job creation." [23]</p> | <p>10.03 ICT use & Gov't efficiency 11.07 Production process sophistication 6.01 Intensity of local competition 6.02 Extent of market dominance 9.02 Firm-level technology absorption 1.02 Intellectual property protection 10.04 E-Participation 10.03 ICT use & gov't efficiency 6.06 No. procedures to start a business 6.07 No. days to start a business 1.11 Efficiency of legal framework in challenging regulations</p> |
| Theme 1 - 10 | IM 1-16 | <p>Unleashing Market Opportunities</p> <p>"Through the Startup America Policy Challenge, the White House is asking entrepreneurs and the broader public for ideas on how we can accelerate entrepreneurial innovation in three priority industries: healthcare, clean energy, and education. Students and other solvers then compete to translate the best ideas into "Policy Business Plans," which will be shared with top Administration officials." [24]</p> | <p>1.12 Transparency of government policymaking 8.01 Gov't prioritization of ICT 8.02 Importance of ICT to gov't vision</p> |
| Theme 1 - 10 | IM 1-16 | <p>"Green Button is the common-sense idea that electricity customers should be able to download their own detailed household or commercial electricity usage data from their utility website. Entrepreneurs can then build tools to help consumers conserve energy and save money." [25]</p> | <p>8.01 Gov't prioritization of ICT 8.02 Importance of ICT to gov't vision 1.02 Laws relating to ICT 6 Household ICT Use 7.04 Extent of business ICT Use</p> |
| Theme 1 - 10 | IM 1-16 | <p>"The Education Data Initiative will harness the power of open data and unleash the creativity and entrepreneurial spirit of educators and innovators all over the country. The Department of Education is allowing students to easily download and share their Federal Student Aid data, and is opening up other data resources to foster new tools for students, parents, and teachers." [26]</p> | <p>8.01 Gov't prioritization of ICT 8.02 Importance of ICT to gov't vision 1.02 Laws relating to ICT 6 Household Usage 7.04 Extent of business ICT Use</p> |
| Theme 1 - 10 | IM 1-16 | <p>"Blue Button provides a secure way for patients to download their health information and share it with health care providers, caregivers, and others they trust. Over 80 million Americans who have health insurance or benefits from the Veterans Administration, Medicare, the Department of Defense, and certain private-sector companies now have access to Blue Button, which promises to fuel innovative new products and services to help Americans manage their health." [27]</p> | <p>8.01 Gov't prioritization of ICT 8.02 Importance of ICT to gov't vision 1.02 Laws relating to ICT 6 Household ICT Use 7.04 Extent of business ICT Use</p> |
| Theme 1 - 10 | IM 1-16 | <p>"The Administration is encouraging a nationwide series of Innovation Exchanges, where early-stage innovators are matched with major healthcare organizations to pilot new solutions in health information technology (IT)." [28]</p> | <p>8.01 Gov't prioritization of ICT 8.02 Importance of ICT to gov't vision 1.02 Laws relating to ICT 6 Household ICT Use 7.04 Extent of business ICT Use 6.15 Degree of customer orientation 6.16 Buyer sophistication</p> |

4. Analysis

This paper uses fuzzy sets / qualitative comparative analysis (fs/QCA) (*Please see Annex 1, for further methodological and mathematical details please refer to Ragin, 2000; 2008*).

4.1 Data

Data are taken from WEF Global Competitiveness and Information Technology surveys and reports (2005-2011); data for the outcome are taken from the Cleantech Group-WWF Global Cleantech Innovation report (2009-2011).

4.2 Selection of Cases

38 countries (cases) are selected from the EU27 and G20 countries, where data is available. Therefore, the case scope of this paper is the EU27 (minus Cyprus, Estonia, Latvia, Lithuania, Luxembourg, Malta, and Slovakia: lack of data.) and G20 countries. Israel, Switzerland, and Norway were added, as data is available and the countries are being regarded as being of relevant in looking at emerging cleantech innovation companies internationally (Cleantech Group, 2012).

4.3 The Outcome

The outcome is *Evidence of Emerging Cleantech Innovation* and Startups score (1) *Patents in cleantech sectors*, (OECD database 2008, Environment-related technology patents filed under the Patent Cooperation Treaty weighted by GDP, 45%); 2) *Early-stage private investment*, (Cleantech Group data 2009 – 2011, Amount of venture capital invested in cleantech startups as a proportion of GDP, 45%); 3) *High impact cleantech start-ups*, (Cleantech Group data 2009 – 2011, Number of companies included in the Global Cleantech 100 weighted by GDP, 10%))

Table 5 – The Outcome

| Country | Score | Country | Score |
|-------------|-------|----------------|-------|
| Denmark | 6.2 | Japan | 4.6 |
| Israel | 8.6 | Spain | 0.7 |
| Sweden | 6.2 | Hungary | 1.4 |
| Finland | 5.7 | Czech Republic | 2.2 |
| USA | 6 | Portugal | 0.7 |
| Germany | 4.9 | Brazil | 0.4 |
| Canada | 4.8 | Argentina | 0.1 |
| South Korea | 5 | Italy | 0.8 |
| Ireland | 3.5 | South Africa | 0.8 |
| UK | 4.2 | Slovenia | 0.8 |
| Norway | 5.1 | Poland | 0.4 |
| India | 2.2 | Indonesia | 0 |
| China | 1.7 | Mexico | 0.2 |
| Netherlands | 4 | Bulgaria | 0.7 |
| Switzerland | 2.6 | Romania | 0.2 |
| Australia | 2 | Greece | 0.2 |
| Austria | 3 | Turkey | 0.2 |
| Belgium | 3.6 | Saudi Arabia | 0.1 |
| France | 2.9 | Russia | 0.3 |

4.4 Construction of the Conditions (2005-2011)

The framework markers- and the initiative-informed, selected variables as a set neither represent the initiative nor the ten themes' indicative markers. Nevertheless, they represent the most explicit and targeted enablers (micro-conditions) by the initiative which is well-mapped with the theoretical-analytical framework and its indicative markers. These micro-conditions are used to construct the causal macro-conditions of the emergence of clean technology innovation and startups. By doing so, it became possible to define a “multi-level” policy design and action guide according to the findings with its concrete elements (micro-conditions) and umbrella concepts (macro-conditions). In this sense, these micro- and macro-conditions provide answers to the question of “what”, for instance, *what are the important factors, umbrella areas, in fostering clean technology innovation and startups?*, simply, focus is *entrepreneurship*. Moreover, this paper neither evaluates nor assesses the Obama Administration’s Startup America Initiative. However, the initiative is selected to demonstrate a real life case consisting of “concrete” policy actions which are basically dependent on the availability/presence of these micro-conditions and which are in line, parallel with the ten-themes (theoretical-analytical framework) and its sixteen indicative markers (concerning new and emerging technologies) in detail. In this sense, the framework markers- and the initiative provide answers to both the question of “why”, for instance, *why are these micro-conditions selected*, and the question of “how”, for instance, *how can the micro-condition “degree of customer orientation” be fostered?, under what umbrella area can a micro-condition be provided?*, simply focus is *governance*.

Table 6 - Construction of the Conditions (2005-2011)

| WEF Codes & Variables | WEF Questionnaire | Constructed Condition (Equal Weights 2005-2011) |
|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| 1.02 Intellectual property protection | How would you rate intellectual property protection, including anti-counterfeiting measures, in your country? | Governance Institutions (8) |
| 1.05 Irregular Payments and Bribes | In your country, how common is it for firms to make undocumented extra payments or bribes connected with (a) imports and exports; (b) public utilities; (c) annual tax payments; (d) awarding of public contracts and licenses; (e) obtaining favorable judicial decisions. | |
| 1.08 Wastefulness of government spending | How would you rate the composition of public spending in your country? | |
| 1.09 Burden of government regulation | How burdensome is it for businesses in your country to comply with governmental administrative requirements (e.g., permits, regulations, reporting)? | |
| 1.11 Efficiency of legal framework in challenging regulations | How efficient is the legal framework in your country for private businesses in challenging the legality of government actions and/or regulations? | |
| 1.12 Transparency of government policymaking | How easy is it for businesses in your country to obtain information about changes in government policies and regulations affecting their activities? | |
| 1.19 Efficacy of Corporate Boards | How would you characterize corporate governance by investors and boards of directors in your country? | |
| 1.21 Strength of investor protection | Strength of Investor Protection Index | |
| 11.07 Production process sophistication | In your country, how sophisticated are production processes? | |
| 9.02 Firm-level technology absorption | To what extent do businesses in your country absorb new technology? | |

| | | |
|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| 7.07 Reliance on professional management | In your country, who holds senior management positions? | Knowledge Sophistication (11) |
| 12.02 Quality of scientific research institutions | How would you assess the quality of scientific research institutions in your country? | |
| 12.04 University-industry collaboration in R&D | To what extent do business and universities collaborate on research and development (R&D) in your country? | |
| 12.06 Availability of scientists and engineers | To what extent are scientists and engineers available in your country? | |
| 5.02 Tertiary education enrollment, gross % | Gross tertiary education enrollment rate | |
| 5.04 Quality of math and science education | How would you assess the quality of math and science education in your country's schools? | |
| 5.05 Quality of management schools | How would you assess the quality of management or business schools in your country? | |
| 5.07 Availability of research and training services | In your country, to what extent are high-quality, specialized training services available? | |
| 7.08 Brain drain | Does your country retain and attract talented people? | |
| 6.01 Intensity of local competition | How would you assess the intensity of competition in the local markets in your country? | Market Configuration (8) |
| 6.02 Extent of market dominance | How would you characterize corporate activity in your country? | |
| 6.03 Anti-monopoly policy | To what extent does anti-monopoly policy promote competition in your country? | |
| 6.04 Extent and effect of taxation | What impact does the level of taxes in your country have on incentives to work or invest? | |
| 6.06 No. procedures to start a business | Number of procedures required to start a business | |
| 6.07 No. days to start a business | Number of days required to start a business | |
| 6.15 Degree of customer orientation | How well do companies in your country treat customers? | |
| 6.16 Buyer sophistication | In your country, how do buyers make purchasing decisions? | |
| 8.01 Availability of financial services | Does the financial sector in your country provide a wide variety of financial products and services to businesses? | Access to Finance (6) |
| 8.02 Affordability of financial services | To what extent does competition among providers of financial services in your country ensure the provision of financial services at affordable prices? | |
| 8.03 Financing through local equity market | How easy is it to raise money by issuing shares on the stock market in your country? | |
| 8.04 Ease of access to loans | How easy is it to obtain a bank loan in your country with only a good business plan and no collateral? | |
| 8.05 Venture capital availability | In your country, how easy is it for entrepreneurs with innovative but risky projects to find venture capital? | |
| 8.06 Soundness of banks | How would you assess the soundness of banks in your country? | |
| 1.02 Laws relating ICT | How would you assess your country's laws relating to the use of information and communication technologies? | Governance ICT (Individual/Business/ Government Use of ICT) (5) |
| 8.01 Government prioritization of ICT | How much priority does the government in your country place on information and communication technologies? | |
| 8.02 Importance of ICT to government vision of the future | To what extent does the government have a clear implementation plan for utilizing information and communication technologies to improve your country's overall competitiveness? | |
| 8.03 Government Online Service | The Government Online Service Index assesses the quality of government's delivery of online services | |
| 10.04 E-Participation | The E-Participation Index assesses the quality, relevance, usefulness, and willingness of government websites for providing online information and participatory tools and services to their citizens | |
| | | Network Readiness (1) |

4.5 Calibration of the Outcome and the Conditions

Table 7 below provides descriptive statistics of the outcome and the conditions.

Table 7 – Descriptive Statistics

| Outcome | Mean | Std. Dev. | Minimum | Maximum | N Cases | Missing |
|-------------------------------------------|-------------|------------------|----------------|----------------|----------------|----------------|
| Evidence of Emerging Cleantech Innovation | 2.552632 | 2.273849 | 0 | 8.6 | 38 | 0 |
| Conditions | Mean | Std. Dev. | Minimum | Maximum | N Cases | Missing |
| Governance Institutions | 4.230122 | 0.6883863 | 2.9302 | 5.3539 | 38 | 0 |
| Knowledge Sophistication | 4.713627 | 0.6706062 | 3.4767 | 5.858 | 38 | 0 |
| Market Configuration | 4.530275 | 0.5338957 | 3.4801 | 5.3307 | 38 | 0 |
| Access to Finance | 4.575755 | 0.6297594 | 3.0628 | 5.4989 | 38 | 0 |
| Governance ICT | 4.575211 | 0.707845 | 3.418 | 5.694 | 38 | 0 |

Table 8 below provides the calibration information (fully-out, cross-over, fully-in thresholds) for the formation of fuzzy-sets. Direct method of calibration is used (Ragin, 2008)

Table 8 – Calibration and Fuzzy Set Memberships

| Outcome | Minimum | Fully-Out (0.05) | Mean | Cross-over (0.50) | Fully-In (0.95) | Maximum |
|-------------------------------------------|----------------|------------------|-------------|-------------------|-----------------|----------------|
| Evidence of Emerging Cleantech Innovation | 0 | 0.70 | 2.552632 | 2.49 | 4.00 | 8.6 |
| Conditions | Minimum | | Mean | | | Maximum |
| Governance Institutions | 2.9302 | 3.54 | 4.230122 | 4.23 | 4.92 | 5.3539 |
| Knowledge Sophistication | 3.4767 | 4.04 | 4.713627 | 4.72 | 5.38 | 5.858 |
| Market Configuration | 3.4801 | 4.00 | 4.530275 | 4.53 | 5.06 | 5.3307 |
| Access to Finance | 3.0628 | 3.95 | 4.575755 | 4.58 | 5.20 | 5.4989 |
| Governance ICT | 3.418 | 3.87 | 4.575211 | 4.58 | 5.24 | 5.694 |

Raw data and fuzzy-transformed values are given in the Table 9 below, according to these three thresholds (fully-out, cross-over, fully-in) of direct method of calibration, the membership values are calculated.

Table 9 – Raw and Fuzzy Values of Cases

| Country ISO3 | Outcome | | Gov. Inst. | | Know. Soph. | | Market Conf. | | Acc. Finance | | Gov. ICT | |
|-----------------|---------|-------|------------|-------|-------------|-------|--------------|-------|--------------|-------|----------|-------|
| | Raw | Fuzzy | Raw | Fuzzy | Raw | Fuzzy | Raw | Fuzzy | Raw | Fuzzy | Raw | Fuzzy |
| ARG | 0.1 | 0.02 | 2.930181 | 0 | 4.040946 | 0.05 | 3.480077 | 0 | 3.06276 | 0 | 3.522 | 0.01 |
| AUS | 2 | 0.31 | 4.888814 | 0.95 | 5.202009 | 0.9 | 5.26916 | 0.98 | 5.294777 | 0.97 | 5.186 | 0.93 |
| AUT | 3 | 0.73 | 4.701039 | 0.89 | 5.099115 | 0.85 | 4.944478 | 0.91 | 4.905891 | 0.83 | 5.09 | 0.9 |
| BEL | 3.6 | 0.9 | 4.445705 | 0.72 | 5.421849 | 0.96 | 4.925695 | 0.9 | 4.97626 | 0.87 | 4.906 | 0.8 |
| BRA | 0.4 | 0.03 | 3.350265 | 0.02 | 4.053491 | 0.05 | 3.516638 | 0 | 4.397388 | 0.3 | 3.87 | 0.05 |
| BGR | 0.7 | 0.05 | 3.299587 | 0.02 | 3.476668 | 0 | 3.77148 | 0.01 | 3.70351 | 0.02 | 3.698 | 0.02 |
| CAN | 4.8 | 0.99 | 5.085804 | 0.98 | 5.377545 | 0.95 | 5.261785 | 0.98 | 5.325514 | 0.97 | 5.326 | 0.96 |
| CHN | 1.7 | 0.21 | 3.90742 | 0.2 | 4.049463 | 0.05 | 4.096108 | 0.08 | 3.995198 | 0.06 | 4.078 | 0.11 |
| CZE | 2.2 | 0.38 | 3.559126 | 0.05 | 4.671339 | 0.45 | 4.386744 | 0.31 | 4.159717 | 0.12 | 4.352 | 0.28 |
| DNK | 6.2 | 1 | 5.295258 | 0.99 | 5.477218 | 0.97 | 5.247803 | 0.98 | 5.085029 | 0.92 | 5.634 | 0.99 |
| FIN | 5.7 | 1 | 5.353941 | 0.99 | 5.858027 | 0.99 | 5.073478 | 0.96 | 5.465095 | 0.99 | 5.492 | 0.98 |
| FRA | 2.9 | 0.69 | 4.517766 | 0.78 | 5.16356 | 0.88 | 5.023209 | 0.94 | 5.046933 | 0.9 | 5.036 | 0.88 |
| DEU | 4.9 | 0.99 | 4.767954 | 0.91 | 5.253109 | 0.92 | 4.937552 | 0.91 | 4.813134 | 0.75 | 5.176 | 0.93 |
| GRC | 0.2 | 0.02 | 3.274057 | 0.02 | 4.127112 | 0.07 | 3.959999 | 0.04 | 4.145436 | 0.11 | 3.914 | 0.06 |
| HUN | 1.4 | 0.14 | 3.443597 | 0.03 | 4.36168 | 0.17 | 3.903076 | 0.03 | 3.947013 | 0.05 | 4.18 | 0.16 |
| IND | 2.2 | 0.38 | 3.930099 | 0.21 | 4.462297 | 0.24 | 4.350484 | 0.27 | 4.819487 | 0.76 | 4.054 | 0.1 |
| IDN | 0 | 0.02 | 3.847726 | 0.16 | 4.047405 | 0.05 | 4.129354 | 0.09 | 4.407597 | 0.31 | 3.69 | 0.02 |
| IRL | 3.5 | 0.88 | 4.883785 | 0.94 | 5.114676 | 0.86 | 5.012391 | 0.94 | 4.363765 | 0.26 | 4.918 | 0.81 |
| ISR | 8.6 | 1 | 4.627244 | 0.85 | 5.13692 | 0.87 | 4.361144 | 0.28 | 4.963966 | 0.86 | 4.938 | 0.82 |
| ITA | 0.8 | 0.06 | 3.323526 | 0.02 | 4.064956 | 0.05 | 4.31217 | 0.23 | 3.810603 | 0.02 | 4.1 | 0.12 |
| JPN | 4.6 | 0.99 | 4.676413 | 0.87 | 5.319318 | 0.94 | 4.9928 | 0.93 | 4.53721 | 0.45 | 5.088 | 0.9 |
| MEX | 0.2 | 0.02 | 3.543175 | 0.05 | 3.629889 | 0.01 | 3.824864 | 0.02 | 3.815475 | 0.03 | 3.79 | 0.03 |
| NLD | 4 | 0.95 | 4.897607 | 0.95 | 5.346555 | 0.95 | 4.880186 | 0.88 | 5.259822 | 0.96 | 5.394 | 0.97 |
| NOR | 5.1 | 0.99 | 5.107541 | 0.98 | 5.274756 | 0.93 | 5.172809 | 0.97 | 5.498922 | 0.99 | 5.344 | 0.96 |
| POL | 0.4 | 0.03 | 3.595233 | 0.06 | 4.162157 | 0.08 | 4.034888 | 0.06 | 4.157772 | 0.12 | 3.776 | 0.03 |
| PRT | 0.7 | 0.05 | 3.965545 | 0.24 | 4.307712 | 0.14 | 4.207039 | 0.14 | 4.647998 | 0.58 | 4.524 | 0.45 |
| ROU | 0.2 | 0.02 | 3.439821 | 0.03 | 3.781135 | 0.02 | 4.0525 | 0.06 | 3.709731 | 0.02 | 3.826 | 0.04 |

| | | | | | | | | | | | | |
|-----|-----|------|----------|-------------|----------|------|----------|-------------|----------|-------------|-------|-------------|
| RUS | 0.3 | 0.02 | 3.492779 | 0.04 | 4.073581 | 0.05 | 3.804666 | 0.02 | 3.454318 | 0 | 3.652 | 0.02 |
| SAU | 0.1 | 0.02 | 4.528316 | 0.79 | 4.314417 | 0.14 | 4.565631 | 0.55 | 4.901146 | 0.82 | 3.418 | 0.01 |
| SVN | 0.8 | 0.06 | 4.071996 | 0.33 | 4.502373 | 0.28 | 4.156583 | 0.11 | 4.050135 | 0.07 | 4.48 | 0.4 |
| ZAF | 0.8 | 0.06 | 4.688807 | 0.88 | 4.026127 | 0.04 | 4.467562 | 0.41 | 5.056509 | 0.91 | 3.952 | 0.07 |
| KOR | 5 | 0.99 | 3.938744 | 0.22 | 5.148844 | 0.88 | 4.724516 | 0.75 | 4.078328 | 0.08 | 5.254 | 0.95 |
| ESP | 0.7 | 0.05 | 3.991209 | 0.26 | 4.53887 | 0.31 | 4.297774 | 0.21 | 4.660973 | 0.6 | 4.404 | 0.33 |
| SWE | 6.2 | 1 | 5.230958 | 0.99 | 5.634979 | 0.98 | 4.997541 | 0.93 | 5.481953 | 0.99 | 5.694 | 0.99 |
| CHE | 2.6 | 0.55 | 4.973119 | 0.96 | 5.650021 | 0.99 | 5.173213 | 0.97 | 5.343248 | 0.97 | 5.5 | 0.98 |
| TUR | 0.2 | 0.02 | 3.53425 | 0.05 | 3.881143 | 0.02 | 4.518398 | 0.48 | 4.129731 | 0.1 | 3.84 | 0.04 |
| GBR | 4.2 | 0.97 | 4.917748 | 0.95 | 5.296078 | 0.93 | 4.979469 | 0.93 | 5.185383 | 0.95 | 5.262 | 0.95 |
| USA | 6 | 1 | 4.718498 | 0.89 | 5.770492 | 0.99 | 5.330693 | 0.99 | 5.220952 | 0.95 | 5.5 | 0.98 |

Note to Table 9: Higher scores denote better performance

4.6 Analysis of Necessary Conditions

For a condition to be necessary condition its membership score on the outcome have to be consistently lower than the membership score of the causal factor under consideration ($Y_i \leq X_i$). A causal condition is conventionally called “necessary” or “almost always necessary” if the consistency score exceeds the threshold of 0.9. *Knowledge Sophistication* and *Governance ICT* are such type of necessary conditions. Coverage indicates the empirical relevance or importance of a condition. Coverage scores indicate these two conditions are also empirically relevant.

Table 10 – Analysis of Necessary Conditions

| Conditions tested: | Consistency | Coverage |
|---------------------------------|-----------------|-----------------|
| Governance Institutions | 0.874929 | 0.798651 |
| <i>Knowledge Sophistication</i> | 0.944286 | 0.873751 |
| Market Configuration | 0.892552 | 0.815584 |
| Access to Finance | 0.813530 | 0.727874 |
| <i>Governance ICT</i> | 0.931211 | 0.860746 |

4.7 Truth Table Minimization at Consistency Level: 0.80

Truth table solution is a list of different combinations of causal conditions which have met specified criteria of sufficiency for the outcome to occur. Figure 1 below represents the truth table minimization at consistency level 0.80. For the raw consistency scores below 0.80, the outcome is set to 0, and above outcome is set to 1 since consistency scores of less than 0.75 mean that there is considerable inconsistency.

Figure 1 - Truth Table Minimization at Consistency Level: 0.80

| fgovinst | fknwsoph | fmkctfg | ffinaccs | number | feeco | raw consist. ▾ | PRI consist. | product |
|----------|----------|---------|----------|--------|-------|----------------|--------------|----------|
| 1 | 1 | 1 | 1 | 14 | 1 | 0.887895 | 0.865844 | 0.768779 |
| 1 | 1 | 1 | 0 | 2 | 1 | 0.875000 | 0.804082 | 0.703571 |
| 0 | 1 | 1 | 0 | 1 | 1 | 0.848943 | 0.709302 | 0.602157 |
| 1 | 1 | 0 | 1 | 1 | 1 | 0.831615 | 0.711765 | 0.591914 |
| 1 | 0 | 1 | 1 | 1 | 0 | 0.608025 | 0.302198 | 0.183744 |
| 1 | 0 | 0 | 1 | 1 | 0 | 0.509317 | 0.221675 | 0.112903 |
| 0 | 0 | 0 | 1 | 3 | 0 | 0.424658 | 0.136986 | 0.058172 |
| 0 | 0 | 0 | 0 | 15 | 0 | 0.165144 | 0.034931 | 0.005769 |

There are three solutions to each truth table analysis: (1) a “complex” solution that avoids using any counterfactual cases (rows without cases—“remainders”); (2) a “parsimonious” solution, which permits the use of any remainder that will yield simpler (or fewer) recipes; (3) an “intermediate” solution, which uses only the remainders that survive counterfactual analysis based on theoretical and substantive knowledge (which is input by the researcher). Generally, intermediate solutions are best set of solutions (Ragin, 2008).

4.7.1 Truth Table Analysis

The parsimonious solution is the minimal set, treating all combinations of conditions (truth table rows) without cases as “don't cares.” The parsimonious solution contains what cannot be eliminated from the most complex solutions. The parsimonious solutions can be considered as informative but incomplete. The solution excludes explanatory power contained by logical remainders (Ragin, 2008).

--- PARSIMONIOUS SOLUTION ---

frequency cutoff: 1.000000
consistency cutoff: 0.831615

| | raw coverage | unique coverage | consistency |
|----------|-----------------|--------------------|-------------|
| fknwsoph | 0.944287 | 0.944287 | 0.873751 |

solution coverage: 0.944287
solution consistency: 0.873751

Cases with greater than 0.5 membership in term fknwsoph:

USA (0.99,1), FIN (0.99,1), CHE (0.99,0.55), SWE (0.98,1),
DNK (0.97,1), BEL (0.96,0.9), CAN (0.95,0.99),
NLD (0.95,0.95), JPN (0.94,0.99), GBR (0.93,0.97),
NOR (0.93,0.99), DEU (0.92,0.99), AUS (0.9,0.31),
KOR (0.88,0.99), FRA (0.88,0.69), ISR (0.87,1),
IRL (0.86,0.88), AUT (0.85,0.73)

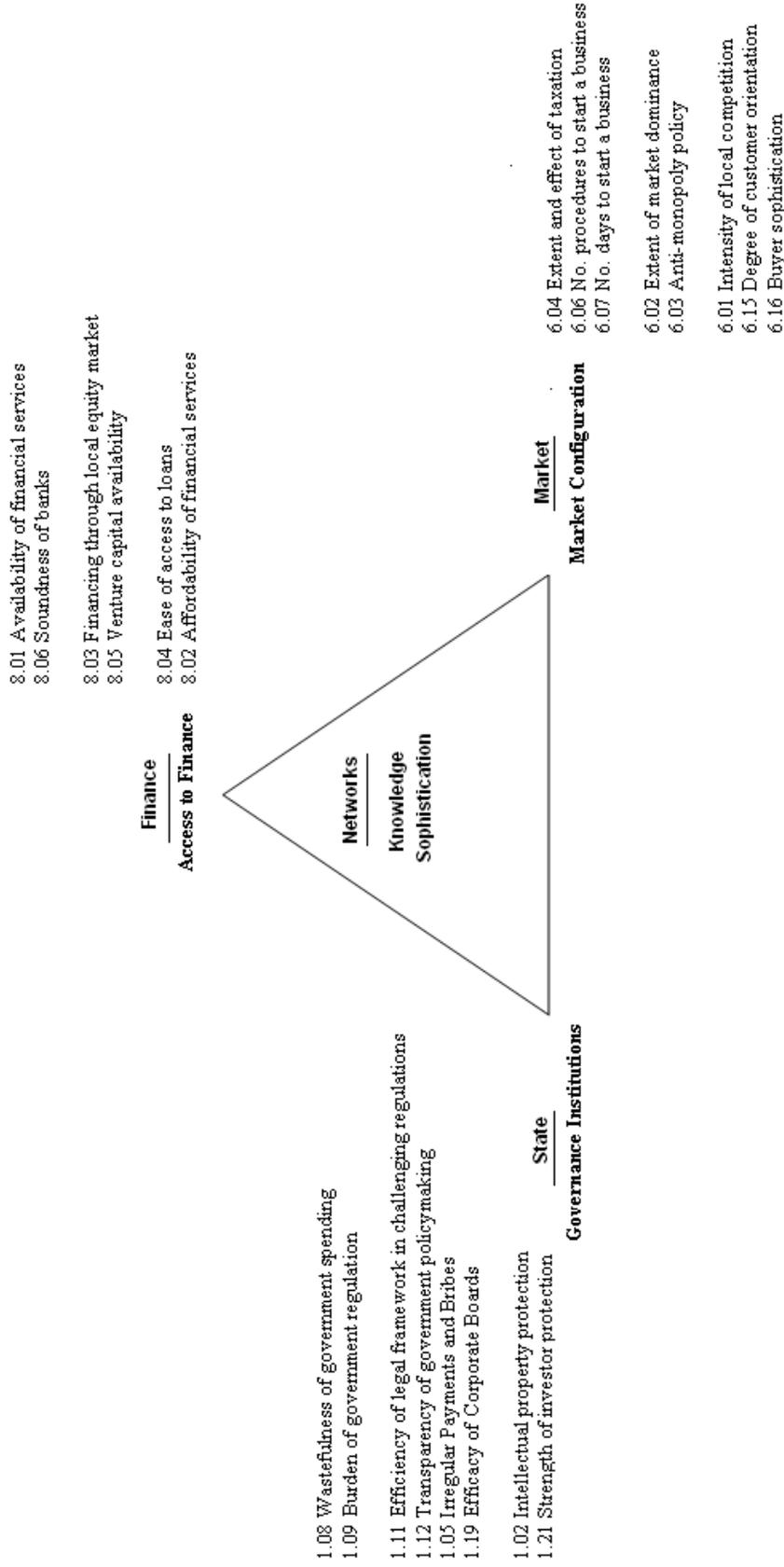
This parsimonious solution suggests that *Knowledge Sophistication* is the locus of the emergence of cleantech innovation and startups.

Formula 1: Knowledge Sophistication (Consistency: 0.876, Coverage: 0.944)

Knowledge Sophistication is a “Knowledge Triangle” between Research, Education and Innovation, or Industry, Intermediaries and University:

- Innovation/Industry: *Production process sophistication, Firm-level technology absorption, Reliance on professional management*
- Research/Intermediaries: *Quality of scientific research institutions, Availability of research and training services, Availability of scientists and engineers, University-industry collaboration in R&D, Brain drain*
- Education/University: *Tertiary education enrollment, gross %; Quality of math and science education; Quality of management schools*

Figure 2 - The Enabler Triangle (A Policy Design and an Action Guide)



4.8 Truth Table Minimization at Consistency Level: 0.80 (Role of Governance ICT)

Figure 3 below represents the truth table minimization at consistency level 0.80. For the raw consistency scores below 0.80, outcome is set to 0, and above outcome is set to 1.

Figure 3 - Truth Table Minimization at Consistency Level: 0.80

| fgovinst | fknwsoph | fmktcfg | ffinaccs | fnetrdi | number | feeco | raw consist. ▾ | PRI consist. |
|----------|----------|---------|----------|---------|--------|-------|----------------|--------------|
| 1 | 1 | 1 | 0 | 1 | 2 | 1 | 0.915254 | 0.867841 |
| 1 | 1 | 1 | 1 | 1 | 14 | 1 | 0.898174 | 0.878864 |
| 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0.891525 | 0.792208 |
| 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0.881226 | 0.796053 |
| 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0.578073 | 0.248521 |
| 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0.493590 | 0.189744 |
| 0 | 0 | 0 | 1 | 0 | 3 | 0 | 0.419580 | 0.126316 |
| 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0.160625 | 0.028783 |

4.8.1 Truth Table Analysis (Separate and Combined Role of Governance ICT)

```
--- PARSIMONIOUS SOLUTION ---
frequency cutoff: 1.000000
consistency cutoff: 0.881226
```

| | raw coverage | unique coverage | consistency |
|----------|-----------------|--------------------|-------------|
| fknwsoph | 0.944287 | 0.029562 | 0.873751 |
| fnetrdi | 0.931211 | 0.016487 | 0.860746 |

```
solution coverage: 0.960773
solution consistency: 0.846269
```

Cases with greater than 0.5 membership in term fknwsoph:

USA (0.99,1), FIN (0.99,1), CHE (0.99,0.55), SWE (0.98,1), DNK (0.97,1), BEL (0.96,0.9), CAN (0.95,0.99), NLD (0.95,0.95), JPN (0.94,0.99), GBR (0.93,0.97), NOR (0.93,0.99), DEU (0.92,0.99), AUS (0.9,0.31), KOR (0.88,0.99), FRA (0.88,0.69), ISR (0.87,1), IRL (0.86,0.88), AUT (0.85,0.73)

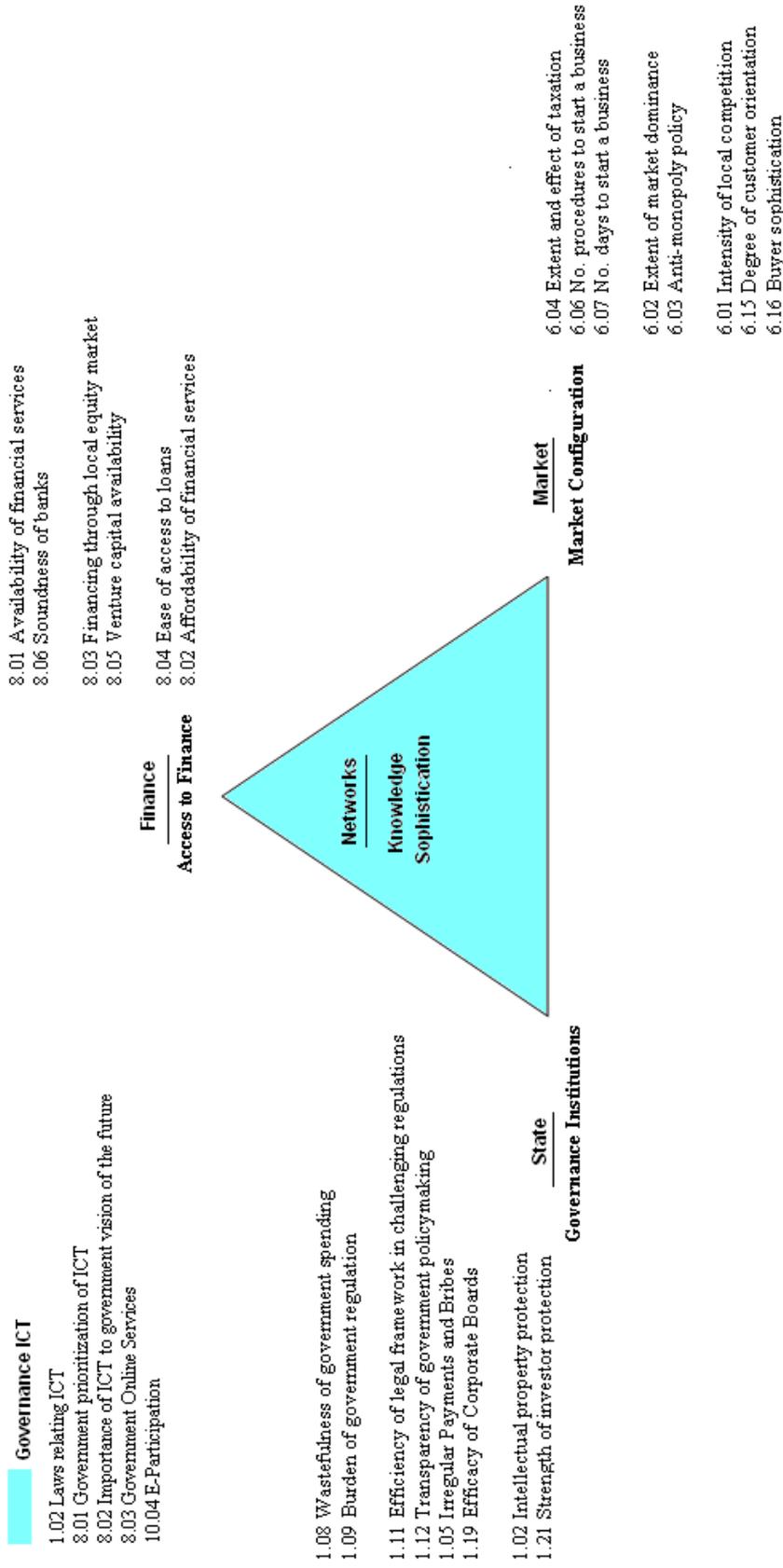
Cases with greater than 0.5 membership in term fnetrdi:

DNK (0.99,1), SWE (0.99,1), USA (0.98,1), CHE (0.98,0.55), FIN (0.98,1), NLD (0.97,0.95), CAN (0.96,0.99), NOR (0.96,0.99), GBR (0.95,0.97), KOR (0.95,0.99), DEU (0.93,0.99), AUS (0.93,0.31), JPN (0.9,0.99), AUT (0.9,0.73), FRA (0.88,0.69), ISR (0.82,1), IRL (0.81,0.88), BEL (0.8,0.9)

This parsimonious solution suggests that *Knowledge Sophistication* is the locus of emergence of cleantech innovation. And *Governance ICT* can also be a locus of emergence of cleantech innovation. The parsimonious solutions can be considered as informative but incomplete.

Formula 3: Knowledge Sophistication OR Governance ICT
(Consistency: 0.846, Coverage: 0.96)

Figure 4 – The Enabler IC(T)riangle (A Policy Design and an Action Guide)



5. Discussions and Conclusions

This paper investigates multi-conjunctural causation (and associated governance) patterns of the emergence of clean technology innovation and startups. The theoretical-analytical framework is based on ten (10) themes typology for eco-innovation policy making and evaluation (Kemp, 2011). The theoretical-analytical framework consists of 1) the need for policy to be based on identified barriers, 2) preventing windfall profits, 3) specific versus generic support policies, 4) balance between policy measures and timing, 5) targeted spending in technological areas where innovation is needed, 6) missions, 7) strategic intelligence for innovation, 8) portfolios, 9) policy learning, 10) policy coordination and public-private interactions (for further details please refer to (Kemp, 2011).

This framework is further detailed into its sixteen (16) indicative markers concerning emerging and new technologies. These indicative markers are 1) Observed Barriers, 2) Prioritization and Targeting of Research Areas, 3) Technological Opportunities, 4) Opportunities of Related Variety, 5) Diversity in Research and Innovation, 6) Knowledge Absorption, 7) Improvement of Innovation System, 8) Regulatory Barriers in Entry/Exit, 9) Regulatory Capture, 10) Policy Adjustment, 11) Good Mix of Policy, 12) Policy Learning, 13) Ambitious Systemic Targets, 14) Policy Signals, 15) Socially and Financially Sustainable Policy, and 16) Positive External Economies.

These indicative markers of the framework and related activities are tracked through the details of the Obama Administration's Start-up America Initiative (5 policy areas and 28 policy actions). In all areas and actions, concrete action designs and implementations are evaluated as consistently parallel to the theoretical-analytical framework and its indicative markers.

The framework markers- and the initiative-informed selection are then performed to choose variables from WEF global competitiveness and information technology reports. In total, thirty four (34) variables are selected which are explicitly targeted or brought into play by the initiative. Therefore, these variables are targeted enabling micro-conditions. These micro-conditions are then used to construct five (5) causal macro-conditions governing the emergence of clean technology innovation and startups.

These causal conditions are: 1) Governance Institutions (*Intellectual property protection, Irregular Payments and Bribes, Wastefulness of government spending, Burden of government regulation, Efficiency of legal framework in challenging regulations, Transparency of government policymaking, Efficacy of Corporate Boards, Strength of investor protection*); 2) Knowledge Sophistication (*Production process sophistication, Firm-level technology absorption, Reliance on professional management, Quality of scientific research institutions, University-industry collaboration in R&D, Availability of scientists and engineers, Tertiary education enrollment, Quality of math and science education, Quality of management schools, Availability of research and training services, Brain drain*); 3) Market Configuration (*Intensity of local competition, Extent of market dominance, Anti-monopoly policy, Extent and effect of taxation, No. procedures to start a*

business, No. days to start a business, Degree of customer orientation, Buyer sophistication); 4) Access to Finance (*Availability of financial services, Affordability of financial services, Financing through local equity market, Ease of access to loans, Venture capital availability, Soundness of banks*), and 5) Governance ICT (*Individual / Business / Government Use of ICT*) or simply, *Networked Readiness*)

Constructing these macro-level conditions allowed us to test if these macro-conditions can explain the emergence of clean technology innovation and start-ups throughout certain political geographies and economies of the world. 38 countries are selected from the EU27 and G20 countries, where data is available. Fuzzy sets / qualitative comparative analysis (fs/QCA) is applied to be able to detect multi-conjunctural causation patterns that can reach equifinality: the emergence of clean technology innovation and startups.

The results show that the locus of the emergence of clean technology innovation and startups is *Knowledge Sophistication*. Simply, networks are central, the sophistication of the Knowledge Triangle (Education, Research, Innovation / University, Intermediaries, Industry) is a necessary condition, however, not a sufficient solution in itself, so, incomplete. This solution can be associated with technology push, supply-side policies, technological frontier-capabilities, and even autonomous technology. On the other hand, *Market Configuration* and *Governance Institutions*, although they are not that central to the process as *Knowledge Sophistication* is, these two conditions play a complementary role, according to low levels (or absence), and high levels (or presence) of *Access to Finance*, respectively; and by coupling with *Knowledge Sophistication*, the overall solution define the multi-conjunctural causation (and associated governance) pattern of the emergence of clean technology innovation and startups. The last part of the solution can be associated with market pull, demand-side policies, policy environment, and finance, but more importantly, the overall solution represents that the issue at hand requires a holistic, socio-technical systems approach. These findings are in line with the theoretical-analytical framework of this paper which draws on the systems of innovation literature and evolutionary-institutional approaches, and also the findings are parallel to the coverage, scope and system-wide inter-linked features of 28 different actions in 5 different policy areas of the Obama Administration's Startup America Initiative. The theoretical-analytical framework and results can be further used to scrutinize the conditions in the interesting country cases.

Therefore, "*The Enabler Triangle*" (State-Finance-Market) could be defined, around *the Knowledge Triangle* (Education, Research, Innovation / University, Intermediaries, Industry). Finally, it is detected that *Governance ICT* has an embedded feature and cultivates both *the Enabler Triangle* around the locus, and the locus itself, which is *Knowledge Sophistication* (Knowledge Triangle). The theoretical-analytical framework and results, therefore, can be further used to construct "*Green IT Initiatives*", policy design and actions. For governance and entrepreneurship, the structure and agents' mutual interaction define the core of policy recommendations. Associated policy design towards the enabler macro-conditions and concrete action guide towards the enabler micro-conditions are illustrated to construct holistic policy initiatives and agendas in the field.

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Annex 1 – Fs/QCA in comparison to Regression Analysis

| Feature | Set-theoretic Qualitative Comparative Analysis | Regression Analysis |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Orientation | Case-Oriented | Variable-oriented |
| Causality | Causal Interpretation | Causal Inference |
| Best Practice | <p>*Clearly explaining how both crisp and fuzzy sets are constructed,</p> <p>*Justifying consistency and coverage on theoretical and substantive grounds,</p> | <p>*Isolating and estimating the effect of a causal variable on an outcome variable, in the face of competition from rival causal variables representing rival explanations of the outcome.</p> <p>*The underlying goal is to approximate the experimental design standard as closely as possible using non-experimental data</p> |
| Causal Homogeneity and Additivity | <p>*QCA avoids assuming causal homogeneity and additivity</p> <p>*QCA seeks to discern the different combinations of causally relevant conditions linked to an outcome.</p> | <p>*The goal of analysis is to estimate the net, independent effect of each causal variable on the outcome.</p> <p>*Estimates typically assume causal homogeneity (that a single causal model applies to all cases) and additivity (that the effect of a causal variable is the same regardless of the values of the other causal variables).</p> |
| Analytic Strategy | QCA is an analytic strategy that structures the dialogue of ideas and evidence in comparative research | Regression analysis is a data analytic technique |
| Analytic Engine | Set-theoretic relations | Correlations |
| Relations | Set theoretic relations are asymmetrical | Correlations are symmetrical |
| Algebra base | Algebra of sets | Linear algebra |
| Structure | Outcome-Conditions | Dependent-Independent Variable |

Source: Ragin C., (2005), Core versus Tangential Assumptions in Comparative Research, <http://polisci.berkeley.edu/people/faculty/CollierD/4c%20-%20Comment%20by%20Ragin%20-%20%202005.pdf> (Accessed May 2012)

Annex 2– Complex Solutions

--- COMPLEX SOLUTION ---
 frequency cutoff: 1.000000
 consistency cutoff: 0.831615

| | raw coverage | unique coverage | consistency |
|----------------------------|-----------------|--------------------|-------------|
| | ----- | ----- | ----- |
| fknwsoph*fmktcfg*~ffinaccs | 0.239340 | 0.090392 | 0.893843 |
| fgovinst*fknwsoph*ffinaccs | 0.776009 | 0.627061 | 0.890411 |

solution coverage: 0.866401
 solution consistency: 0.897527

Cases with greater than 0.5 membership in term fknwsoph*fmktcfg*~ffinaccs:

KOR (0.75,0.99), IRL (0.74,0.88), JPN (0.55,0.99)

Cases with greater than 0.5 membership in term fgovinst*fknwsoph*ffinaccs:

FIN (0.99,1), SWE (0.98,1), CHE (0.96,0.55), CAN (0.95,0.99),
 NLD (0.95,0.95), NOR (0.93,0.99), GBR (0.93,0.97), DNK (0.92,1),
 AUS (0.9,0.31), USA (0.89,1), ISR (0.85,1), AUT (0.83,0.73),
 FRA (0.78,0.69), DEU (0.75,0.99), BEL (0.72,0.9)

--- COMPLEX SOLUTION ---
 frequency cutoff: 1.000000
 consistency cutoff: 0.881226

| | raw coverage | unique coverage | consistency |
|------------------------------------|-----------------|--------------------|-------------|
| | ----- | ----- | ----- |
| fknwsoph*fmktcfg*~ffinaccs*fnetrdi | 0.229107 | 0.086981 | 0.926437 |
| fgovinst*fknwsoph*ffinaccs*fnetrdi | 0.766913 | 0.624787 | 0.899933 |

solution coverage: 0.853894
 solution consistency: 0.905911

Cases with greater than 0.5 membership in term fknwsoph*fmktcfg*~ffinaccs*fnetrdi:

KOR (0.75,0.99), IRL (0.74,0.88), JPN (0.55,0.99)

Cases with greater than 0.5 membership in term fgovinst*fknwsoph*ffinaccs*fnetrdi:

FIN (0.98,1), SWE (0.98,1), CHE (0.96,0.55), CAN (0.95,0.99),
 NLD (0.95,0.95), NOR (0.93,0.99), GBR (0.93,0.97), DNK (0.92,1),
 AUS (0.9,0.31), USA (0.89,1), AUT (0.83,0.73), ISR (0.82,1), FRA (0.78,0.69), DEU
 (0.75,0.99), BEL (0.72,0.9)

Annex 3– Absence of Emerging Cleantech Innovation and Startups

In best-practice fs/QCA analyses, negation of the outcome is also investigated. Absence or low levels of *Knowledge Sophistication*, *Governance Institutions*, *Market Configuration* and *Governance ICT* lead to absence or low levels of emergence of cleantech innovation and startups. Even if *Governance Institutions* and *Access to Finance* are present, lack of *Knowledge Sophistication* and *Governance ICT* leads to the absence or low levels of emergence of cleantech innovation and startups.

--- INTERMEDIATE SOLUTION ---

frequency cutoff: 1.000000
 consistency cutoff: 0.860465
 Assumptions:

| | raw coverage | unique coverage | consistency |
|----------------------------------------|-----------------|--------------------|-------------|
| ~fnetrdi*~fmktcfg*~fknewsoph*~fgovinst | 0.734934 | 0.634983 | 0.967118 |
| ~fnetrdi*ffinaccs*~fknewsoph*fgovinst | 0.174424 | 0.074473 | 0.894472 |

solution coverage: 0.809407
 solution consistency: 0.966647

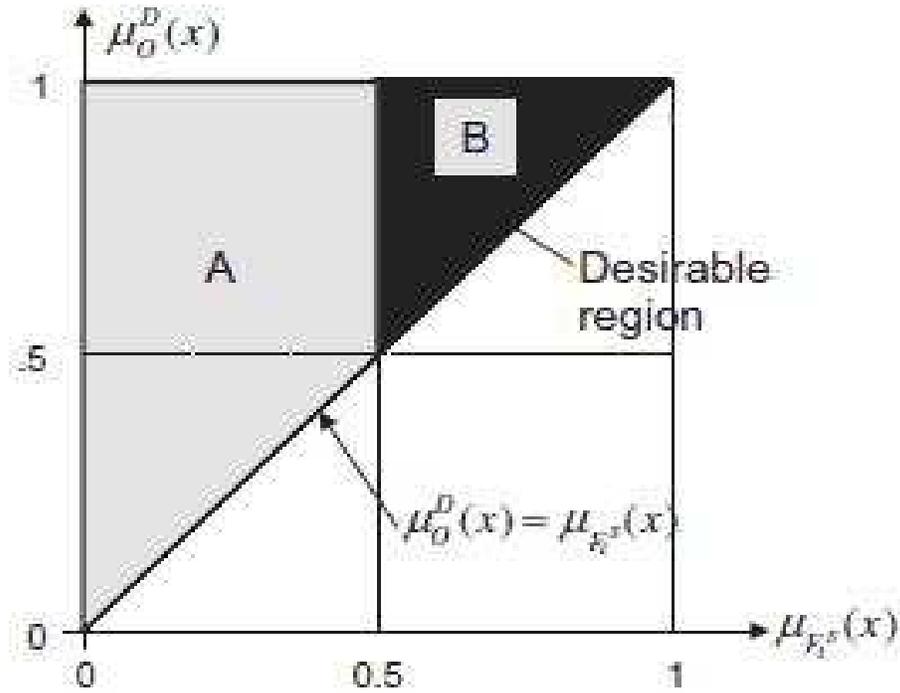
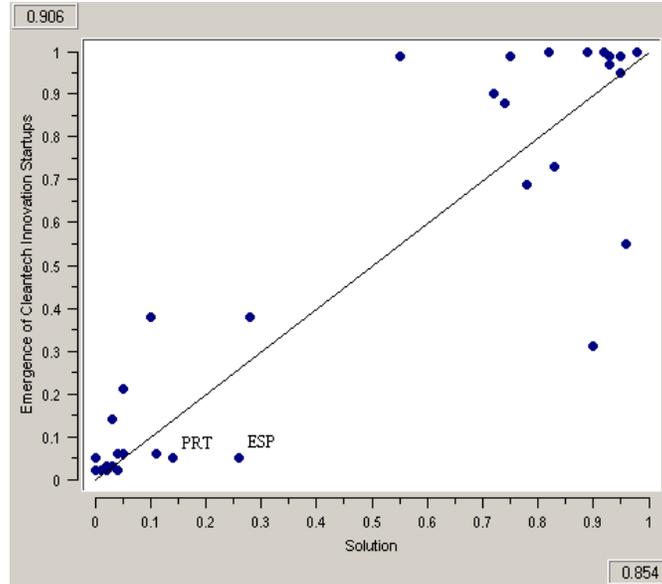
Cases with greater than 0.5 membership in term
 ~fnetrdi*~fmktcfg*~fknewsoph*~fgovinst: BGR (0.98,0.95),
 ARG (0.95,0.98), BRA (0.95,0.97), RUS (0.95,0.98),
 MEX (0.95,0.98), ROU (0.94,0.98), GRC (0.93,0.98),
 POL (0.92,0.97), IDN (0.84,0.98), HUN (0.83,0.86),
 CHN (0.8,0.79), ITA (0.77,0.94), IND (0.73,0.62),
 ESP (0.67,0.95), SVN (0.6,0.94), PRT (0.55,0.95),
 CZE (0.55,0.62), TUR (0.52,0.98)
 Cases with greater than 0.5 membership in term
 ~fnetrdi*ffinaccs*~fknewsoph*fgovinst: ZAF (0.88,0.94),
 SAU (0.79,0.98)

“Large-scale targeted government intervention in the innovation system and support to knowledge-based firms, technologies, products and services are required to compensate for declining innovation support from the private sector and boost economic growth. ‘Picking winners’ approaches that proved successful during World War II and afterwards need to be revisited, to hasten recovery from the current economic crisis and manage the transition to a knowledge-based regime.”

Source: Etzkowitz H, Ranga M. (2009), A trans-Keynesian vision of innovation for the contemporary economic crisis: ‘picking winners’ revisited, *Science and Public Policy* 36 (10): 799-808

Annex 4 – Fs/QCA XY Plot – The Solution

Figure Appendix C - fs/QCA XY Plot – The Solution
(Consistency: 0.906, Coverage: 0.853)



“Consistency Region: Regions A and B are where maximum consistency can occur.”

Source: J.M. Mendel, M. Korjani, Charles Ragin’s Fuzzy Set Qualitative Comparative Analysis (fsQCA) used for linguistic summarizations, *Inform. Sci.* (2012), <http://dx.doi.org/10.1016/j.ins.2012.02.039> (Accessed May 2012)