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Understanding G.A.R.L.I.C.s.: An Innopreneurship Platform for Smart Cities

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Abstract

The intent of this paper is to identify key actors of a sustainable Smart City and define metrics that will allow assessment and better management of Sustainable Smart Cities. The paper is organized in two major segments. The first segment reviews the definition, six components, six action items of Smart Cities. It describes briefly a sample Smart City project and presents a selection of different dimensions along which Smart Cities are ranked and the rankings. The segment also discusses the technology architecture of a Smart City and then examines the definition and components of an innovation platform. The second presents the original contributions of the paper. It first introduces the dynamics created seven key actors of a Smart City ecosystem and describes their existing and potential contributions. It then defines Innopreneurship platform and presents a triple bottom line based quality metric to evaluate such a platform. This segment also discusses reengineering an economy and suggests a Smart City's Innovation Platform Score. The actions to be taken by the key actors of a Smart City in order to make it a Sustainable Smart City are described in several subsections. We hope these concepts and metrics will be a good starting point and will be refined over time by others.

I. INTRODUCTION

The intent of this paper is to propose metrics to measure and manage the effectiveness of sustainable Smart Cities by identifying its key actors and capturing the dynamics among them. It analyses programmes deployed by successful Smart Cities, examines the reasons behind their success and uses the findings to define metrics that will help benchmark Smart Cities.

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The examples are drawn from US, Israel and Singapore and therefore its coverage is neither comprehensive nor complete. US is chosen because it has continuously launched several new industry creating innovations whether technology driven or otherwise. Israel is chosen since it is generally branded as "The Startup Nation" and is a prime example of a small and savvy country that has successfully scaled their startups into the American markets. Singapore is chosen for two reasons. Firstly, it places among the top ten in a number of smart city rankings and secondly, I have lived there for thirty four years and have been intimately involved in its innovation and entrepreneurship programmes. There are also a few notable examples drawn from some other countries as well.

In this paper the term "Innopreneurship" refers to innovation based entrepreneurship. Innopreneurs are individuals who successfully identify, develop and commercialize innova-

Fig. 1. Brussel's Smart City Wheel

Source: Brussels Smart City (2019)

tive products, services or processes. They have an entrepreneurial mindset and are innovation driven. Innopreneurs need to manage market, technology and business risks whereas business leaders generally focus only on managing business risk.

GARLICs denotes the acronym G.A.R.L.I.C.s generated by the seven actors of an Innopreneurship platform. Section 2 introduces the concept of smart cities and innovation platforms. The dynamics of an innopreneurship platform are discussed in section 3. Section 4 discusses **GARLICs** platform in the context of smart cities and offers a means of calculating a score for a sustainable smart city. The critical actors and programmes that can help build a sustainable smart city are discussed in section 5. Section 6 summarises the discussions in the rest of the paper.

2. SMART CITIES AND INNOVATION PLATFORM - A RECAP

In this section we describe smart cities and innovation platform concepts both as an introduction to first timers and as a refresher to those who are already aware of the concepts.

2.1 Smart city

Smart city is a designation given to a **city** that incorporates information and communication technologies (ICT) to enhance the quality and performance of urban services such as energy, transportation and utilities in order to reduce resource consumption, wastage and overall costs. The overarching aim of a smart city is to enhance the quality of living for its citizens by leveraging smart technologies.

2.1.1. A sample smart city project

The Brussels smart city projects are used as an example in this paper (Brussels Smart City, 2019). The wheel shown in Figure 1 is a representation of Brussels smart city projects that was inspired by the definition of the smart city formulated (Townsend, 2013) - "A smart city is a place where ICTs are combined with infrastructure, architecture, daily objects and even our body, in order to tackle social, economic and ecological problems." Such a definition implies that the objective of any smart city ought to be driven by Triple Bottom Line (TBL) — Financial, Social and Environmental as shown in Figure 2.
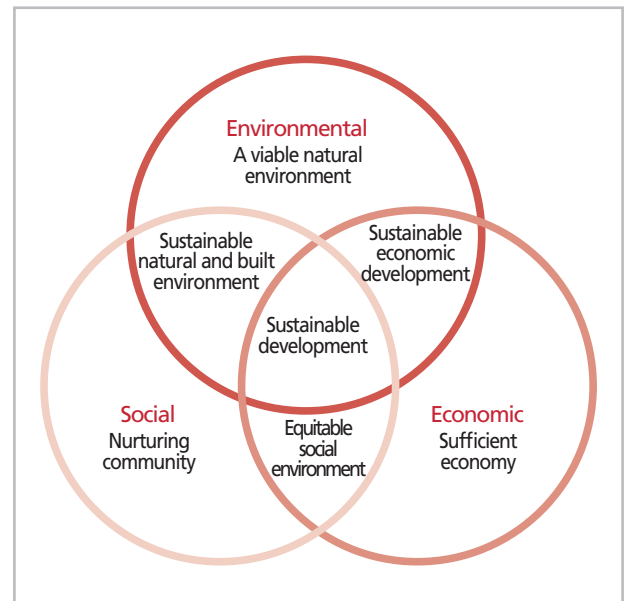

Fig. 2. Triple bottom line for sustainable development

Source: Brussels Smart City (2019)

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Brussels smart city projects define the following as their objectives (Brussels Smart City, 2019).

- Sustainable development in response to ecological issues.
- Human development in response to social issues.
- Economic development in response to the issues of prosperity.

These three objectives are tightly aligned with the Triple Bottom Line introduced earlier.

2.1.2. Components of a Smart City

Boyd Cohen's Smart City Wheel shown in Figure 3 representing six components of a smart city has been widely embraced by several smart city projects (Cohen, 2012; Peek and Troxler, 2014).
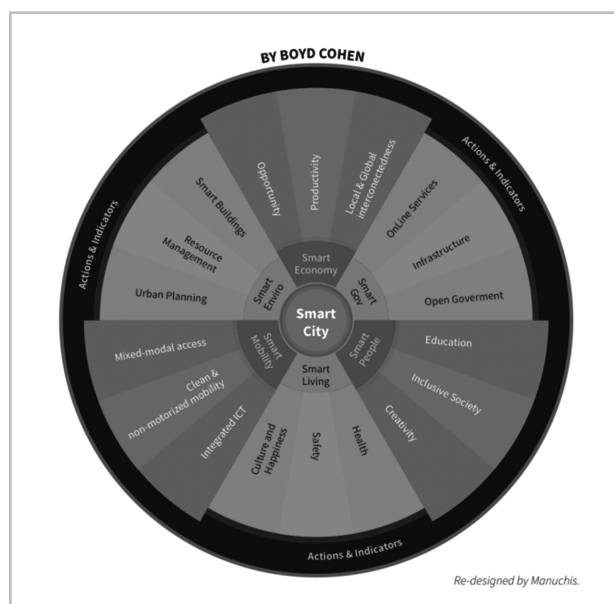

Fig. 3. Boyd Cohen's Smart City Wheel

Source: Cohen (2013)

The six components of a smart city as defined by Boyd Cohen's Smart City Wheel are:

- Smart economy: Smart cities should attract and use talent to build an innovation based economy. Smart cities ought to understand and relate to the need to reengineer their economies on a regular basis in order to avoid stagnant economies.
- Smart governance: Smart cities should offer digital tech-

nology and digital data powered public services.

- Smart environment: Smart cities should offer environment friendly living space, that reduce consumption of energy, natural resources and pollution.
- Smart mobility: Smart cities should offer low congestion and pollution by promoting collective and sustainable travel.
- Smart population: Smart cities should train their citizens to seamlessly transition from one economy to the next. Citizens should also have access to information that will help them design and organize a sustainable lifestyle.
- Smart living environment: Smart cities should offer the highest levels of healthy and safe living.

2.1.3. Smart city action items

The following are the six action items are used by Brussels smart city projects to achieve their objectives.

- Collaborate: Public services should operate in an open environment in a smart city. They must share their data and projects to ensure that citizen focused services are more efficient and effective while achieving economies of scale.
- Save: Smart cities should aim to reduce the use of energy, water, raw materials, food, financial resources and polluting emissions in order to achieve a sustainable future.
- Innovate: Smart cities should establish policies and programmes to encourage its citizens, businesses and public services to come up with new ways of organizing, sharing, communicating and producing products and services for a sustainable future
- Integrate: Smart cities' policies and programmes ought to reduce social divisions in areas such as education, gender, health, and safety.
- Participate: Smart cities must involve its citizens and businesses in planning projects for achieving a sustainable future.
- Simplify: Smart cities remove and revise regulations or customs that are either obsolete or counterproductive and often out of phase with the simplicity of web-based services.

2.1.4. Smart city rankings

There are several smart city rankings each using a different set of metrics. It is however important to note that some cities consistently appear in the top ten of all notable rakings.

In 2017 Juniper Research (Burggraf, 2018) used Intel spon-

sored Global Smart City Performance Index to rank top 20 cities that successfully integrated IOT technologies and connected services across Mobility, Healthcare, Public safety and Productivity to give back more time to the citizens of a city. These were Singapore, London, New York, San Francisco, Chicago, Seoul, Berlin, Tokyo, Barcelona, Melbourne, Dubai, Portland, Nice, San Diego, Rio De Janeiro, Mexico City, Wuxi, Yinchuan, Bhubaneswar and Hangzhou in that order.

In 2017 EasyPark (2017) group also did a survey of five hundred cities two hundred of them considered to be smart. They defined metrics based on 19 factors to rank smart cities. They listed Copenhagen, Singapore, Stockholm, Zurich, Boston, Tokyo, San Francisco, Amsterdam, Geneva and Melbourne as top ten smart cities.

In July 2018 Forbes (IESE Business School, 2018) carried an article from an IESE Business school that ranked New York, London, Paris, Tokyo, Reykjavik, Singapore, Seoul, Amsterdam and Hong Kong as the ten smartest cities of the world. The study used IESE Cities in Motion Index (CIMI) for the ranking.

None of these studies have explicitly included a city's ability to regularly reengineer its ageing economy which we believe to be an important characteristic of a Smart City. Such a metric will be discussed later in the paper.

2.1.5. Smart city technology architecture

Brussels smart city projects define their technology architecture to comprise of three "layers".

- The lowest layer, continually growing digital data is a smart city's raw material.
- The middle or infrastructure layer interconnects all the necessary equipment to offer access to available data.
- The top or smart layer generates information from the data for access and use by government, citizenry and businesses. services.

2.2. Innovation platforms

Innovation platforms are vehicles to bring together different stakeholders to identify solutions to common problems or to achieve common goals (Tui et al., 2013). Innovation platforms caught the attention of development agencies at the end of the 1980s when private sector started using such platforms to gather information and improve networking among its key stakeholders. Innovation platforms are increasingly common in research and development initiatives.

2.2.1. Definition of an innovation platform

UK government defines an innovation platform as a space for learning and change (Tui et al., 2013). It defines an innovation platform to be a group of individuals (who may represent organizations) with different backgrounds and interests - farmers, agricultural input suppliers, traders, food processors, researchers, government officials etc. Its members come together to develop a common vision and find ways to achieve their goals. They may design and implement activities as a group or coordinate activities by individual members. Individual members can also innovate alone, spurred on by the coordinated group activities.

2.2.2. Extending the participants in an innovation platform

Many smart city projects such as Brussels smart city project define a platform to be made up of four main actors - government (public services), citizens, businesses and academic world (universities). While this is a good starting point there is a need to examine some of the actors in some detail.

Businesses merit further subdivision into large businesses, small and medium businesses and investors given the difference in their capabilities and roles in a Smart City project. Non-profits such as research institutes deserve to be considered as a separate category of business given their unique nature and role.

Universities should be generalized to academic institutions to additionally include secondary (grades 7-12) educational institutions and perhaps primary schools (grades 1-6) given that good ideas could originate from students and teachers of any of these institutions.

The reason for subdividing businesses as an actor is simply because the policies and programs for different categories of business will have to be different. The reason for expanding educational institutions beyond universities is to instil the spirit, knowledge and mindset for entrepreneurship and innovation from the earliest possible ages.

Thus the stakeholders involved in an innovation enabled entrepreneurship platforms will be

- **G**overnment
- **A**cademic institutions – primary, secondary and tertiary
- **R**esearch institutions that focus on translational efforts
- **L**arge enterprises that include both natives and multinationals
- **I**nvestors including angel investors and crowd equity funding communities
- **C**itizens

• **s**mall and Medium Enterprises that include startups.

These conveniently abbreviate into **GARLICs**. A lower case S is used to represent Small and Medium Enterprises. '**GARLICs**' is an extension of CUGAR that was developed as an innovation platform for Science and Technology Parks (Narasimhalu, 2013). Legal, Accounting, Media and other service agencies will fall under citizen, SME or large enterprise categories depending on the size of their manpower and revenue.

Innovation platforms can be set up to tackle challenges and opportunities at various levels: in a village or community, in a district or across a nation, or throughout a value chain of an economic sector. A typical seven stage process deployed by innovation platforms is shown in Figure 4．
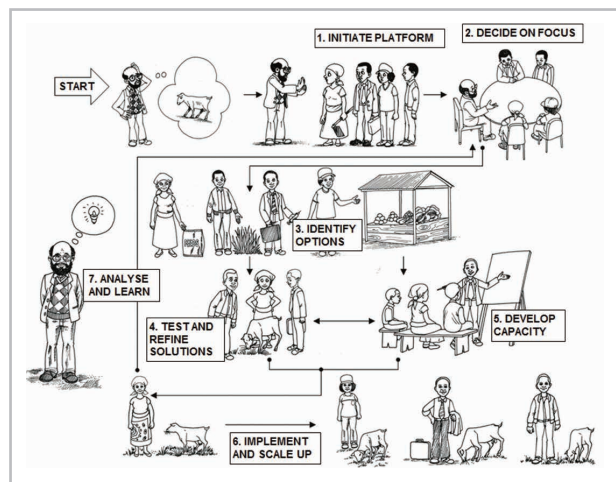

Fig. 4. The seven stage process used by Innovation Platforms

Source: Tui et al. (2013)

3. THE DYNAMICS OF AN INNOPRENEURSHIP PLATFORM

An Innopreneurship platform is an innovation platform that is entrepreneurial in nature or is run by entrepreneurs. Intensive and comprehensive participation and contributions from and to all actors in an Innopreneurship platform is essential for it to be most effective. Such contributions can take the form of policies, programs, recommendations and guidance.

The interaction between each of the seven actors and the rest in an Innopreneurship platform can be represented as a total graph as shown in Figure 5. Each link in the graph represents two actors and their contributions to each other. It is also important to note that all seven actors have to renew and reinvent themselves in addition to contributing to the rest. The contributions of each of the actors are presented in Tables 1 through 7. Service agencies that are one person driven, Small and Medium Enterprises or Large Enterprises provide services not just to innovation platforms but to the rest of the business world as well. They perform "Business as Usual" and do not play any special role in innovation platforms. They are therefore not discussed in the tables. Existing policies and programs are represented in normal typeface with attribution to the country that has implemented them. Policies and programs that should be introduced are represented in italics. Some of the programs in italics may exist and may either not be practiced extensively or not known widely. Programs and policies that are probably practiced but cannot be easily attributed are represented in normal typeface.

Quality of an innopreneurship platform is the positive reinforcement every actor has on every other actor.
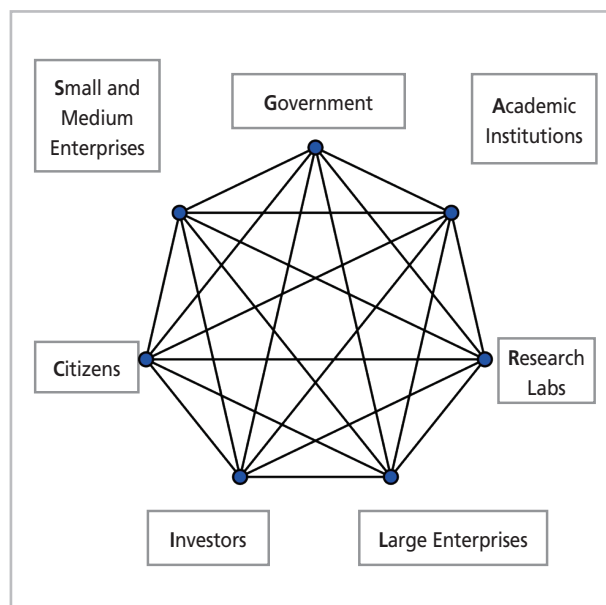

Fig. 5. Innovation Platform Actors interaction graph

Source: author (2013)

Table 1. Sample Programs and policies that a government can offer to other Innopreneurship Platform actors

Contributor	Beneficiary	Components or programs
Government	Government	FAST: Federal and State Technology Partnership (USA) BIRD: Binational Industrial R&D program (USA, Israel) SIIRD: Singapore Israel Industrial R&D program (Israel, Singapore) Repurposing older resources for emerging industry - Euratechnologies (France)[1]
	Academic institutions	STTR: Small Business Technology Transfer (USA) Sophia Antipolis (France)[2] UIF: University Innovation Funds (Singapore) YES: Young Entrepreneurs' Scheme (2008 Singapore) ACE: Action Community for Entrepreneurship Scheme (2013 Singapore)
	Research Labs	STTR: Small Business Technology Transfer (USA) Sophia Antipolis (France)
	Large Enterprises	Generic Technology Program (Israel) Sophia Antipolis (France) PIC: Productivity and Innovation Credit Scheme (Singapore) EDB Investments (Singapore) Enterprise Development Grant (Singapore) Productivity Solutions Grant (Singapore)
	Investors	YOZMA (Israel) – created Venture Capital Industry[3] TIS: Technology Incubator Scheme (Singapore) ESVF: Early Stage Venture Fund (Singapore) SEEDS Capital (Singapore) AITD: Angel Investor Tax Deduction (Singapore) FMI: Fund and Fund Management Incentives (Singapore)
	Citizens	Skills Future (Singapore) *Minds Future*
	Small and Medium Enterprises	SBIR: Small Business Innovation Research (USA)[4] STTR: Small Business Technology Transfer (USA)[4] TIBBETS Award: Top SBIR performers (USA)[4] BIRD: Binational Industrial R&D program (USA, Israel) Generic Technology Program (Israel)[5] Industrial and Technology Incubators (Israel) Sophia Antipolis (France) [Sophia] PIC: Productivity and Innovation Credit Scheme (Singapore) Startup SG Founder Incubation Grant (Singapore)[6] Startup SG Tech (Singapore) Enterprise Development Grant (Singapore) Productivity Solutions Grant (Singapore) SME Micro Loan (Singapore) SME Working Capital Loan (Singapore) SME Venture Loan (Singapore) SME Equipment and Factory Loan (Singapore) IFS: Internationalization Financing Scheme (Singapore) LIS: Loan Insurance Scheme (Singapore) PRIS: Political Risk Insurance Scheme (Singapore) SG Innovate: Deep technology business building (Singapore) TCIS: Trade Credit Insurance Scheme (Singapore)

Source: author

[1] Euratechnlogies. https://en.euratechnologies.com/

[2] Sophia Antipolis. http://www.investincotedazur.com/en/sophia-antipolis/

[3] The Yozma group. http://www.yozma.com/overview/

[4] Small Business Innovation Research. https://www.sbir.gov/about

[5] Israel-US Binational Industrial Research and Development. https://www.sbir.gov/about

[6] Enterprise Singapore. https://www.enterprisesg.gov.sg/

Table 2. Academic institutions' sample contributions to other Innopreneurship Platform actors

Contributor	Beneficiary	Components or programs
Academic Institutions	Government	*Help train innovation minded civil service* *Propose developing innovative and productive citizen services*
	Academic institutions	Karolinska Innovation's START and DRIVE (Sweden)[7] Develop Innovation and Entrepreneurship related academic programs (SMU / NTU , Singapore) Establish entrepreneurial culture (SMU / NUS, Singapore) YIC: Youth Innovation Competition for secondary schools (SMU, Singapore) AYEP: Asian Youth Entrepreneurship Programme for cross-country entrepreneurship programs (SMU, Singapore)
	Research Labs	HADASSIT Hebrew University's medical commercialization company (Israel) WARF: Wisconsin Alumni Research Foundation (USA)[8]
	Large Enterprises	Industry leaders as mentors and instructors (IIT Madras India) *Innovation and Innopreneurship oriented Executive Development Programs (Universities?)* Innovation subcontracts (SMU-X Bank, Singapore)
	Investors	Karolinska Development (Sweden)[9]
	Citizens	Innopreneurship focused continuing education programs (ISS/NUS, Singapore)
	Small and Medium Enterprises	*Innopreneurship Partnership programs* Innovation catalyst programmes (SMU, Singapore) *Adjacent innovations catalyst programme*

Source: author

Table 3. Research labs' sample contributions to other Innopreneurship Platform actors

Contributor	Beneficiary	Components or programs
Research Labs	Government	*Guidance on science and technology trends*
	Academic institutions	*Guidance on market opportunities* *Translational projects around promising scientific and technological inventions*
	Research Labs	*Collaborative projects for solving big problems*
	Large Enterprises	*Offer innovative market ready product / service prototypes*
	Investors	*Offer investment opportunities in first of a kind innovations*
	Citizens	*Meet the citizen session to inspire latent and budding innovators and entrepreneurs*
	Small and Medium Enterprises	*Develop next generation innovation as an innovation outsourcing partner*

Source: author

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[7] Karolinska Innovation. https://karolinskainnovations.ki.se/en/
[8] Wisconsin Alumni Research Foundation. https://www.warf.org/
[9] Karolinska Development. https://www.karolinskadevelopment.com/en/who-we-are

Table 4. Large Enterprises' selected contributions to other Innopreneurship Platform actors

Contributor	Beneficiary	Components or programs
Large Enterprises	Government	*Guidance on market and industry dynamics* *Guidance on skill sets required for future markets and industries*
	Academic institutions	Establish Joint R&D Labs (Intel's Lablets) *Create Translational R&D Labs* *Guidance on skill sets required for future workforce*
	Research Labs	*Inputs on Market demands*
	Large Enterprises	Initiate and Foster Innovation Culture (3M, P&G, Apple, Google) Establish Open Innovation Labs (P&G) Establish joint ventures (Sony, Ericsson)
	Investors	Establish Venture Funds (Nokia Ventures, Intel Capital) Establish partnerships with Venture Capital[10]
	Citizens	Sponsor innovation competitions (Abbott Labs) *Hire individuals with innovation mindset*
	Small and Medium Enterprises	*Provide market and product development expertise as a means to later acquire or establish joint venture the SME.*

Source: author

Table 5. Values that investors can offer to other Innopreneurship Platform actors

Contributor	Beneficiary	Components or programs
Investors	Government	Use pension and other funds to offer better returns
	Academic institutions	Contribute to incubation and acceleration programmes (SMU, Singapore) Contribute to Innopreneurship oriented academic programmes (SMU, Singapore)
	Research Labs	*Inputs on market needs and wants both explicit and implicit* *Innovation brokerage*
	Large Enterprises	Active partnership to create new entities targeted for acquisition a la CISCO (USA)[11]
	Investors	*Partner earlier and later stage investors for seamless progression of promising companies*
	Citizens	*Establish equity crowd funding for all stages of a company*
	Small and Medium Enterprises	*Actively advise on M&A opportunities* *Inputs on market needs and wants both explicit and implicit*

Source: author

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[10] Bort, J. (21 Sep. 2014) "Why Cisco has shownered these 3 men with billions of dollars", BUSINESS INSIDER.

[11] *ibid*.

Table 6. How citizens can contribute to other Innopreneurship Platform actors

Contributor	Beneficiary	Components or programs
Citizens	Government	*Continuous feedback on social and environmental challenges*
	Academic institutions	*Inputs on demands for the workforce of the future*
	Research Labs	*Help validate demand for innovations*
	Large Enterprises	Feedback on current and future offerings Consumer inspired innovation requests (P&G, Zara)
	Investors	Micro investments
	Citizens	Innopreneurship Mentorships
	Small and Medium Enterprises	Feedback on current and future offerings

Source: author

Table 7. Values that SMEs can offer to other Innopreneurship Platform actors

Contributor	Beneficiary	Components or programs
Small and Medium Enterprises	Government	*Demand for growth oriented talent*
	Academic institutions	*ITalent acquisition plans*
	Research Labs	*Know-how needs*
	Large Enterprises	Partnership, JV and M&A opportunities
	Investors	Growth oriented investment needs
	Citizens	Employment opportunities
	Small and Medium Enterprises	*Partnership to complete a value chain / network*

Source: author

If a score of +1 is assigned to represent maximum positive contributions, a score of 0 to represent neutral or no contribution and a score of -1 to represent maximum negative contribution then the maximum score that any actor can earn is 7 and the minimum score that the actor can earn is -7. How a score between -1 and +1 is assigned to an actor for contributions is beyond the scope of this paper.

The maximum raw score for the quality of an innopreneurship platform will be 49 and the minimum raw score will be -49. The normalized innopreneurship platform's score (NIPS) can be calculated by the formula (Raw score + 49) / 10. The NIPS of a smart city can range between 0 and 10 (9.8 rounded to 10).

4. INNOVATION PLATFORMS APPLIED TO A SMART CITY

A close examination of smart cities will reveal that they have one irrefutable trait — their ability to reinvent or reengineer their economies on a regular basis. For example, Singapore started with manufacturing economy and then moved into IT

Table 8. Triple Bottom Line scores for an Innovation Platform

Nature of innovations created by an Innovation Platform	Innovation Platform's TBL Score
Any one of Economic, Social or Environmental dimensions	1
Any one pair of the above three dimensions	2
Any two pairs of the above three dimensions	3
All the above three dimensions	4
All innovations address all three dimensions	5

Source: author

and finance industries to rejuvenate its economy. She is at present heading full steam transitioning into knowledge based and innovation enabled economy.

A stellar example of a smart city / region is the Silicon Valley. They have used startups to fuel the stability and growth of their region by regularly creating new industries. Silicon valley started with electronics, moved into Internet including ecommerce, search and other subindustries, transitioned into Biopharmaceuticals and is currently creating an economy fuelled by Artificial Intelligence, Big Data and Block Chain technologies. The main driving force that enabled such transitions was not just its regional governments. It was indeed the plenitude of diverse entrepreneurial talent and enlightened investment community that helped create several new industries.

The key, if not the only, indicator for the sustainability and growth of a smart city is its ability to stabilize or grow its economy by embracing, fostering and helping grow new industries. None of the smart city definitions tend to capture this important indicator. A smart city that does not proactively use Innopreneurship platforms to create disruptions to its economy will end up producing incremental innovations that either stagnate or spiral down its economy.

An Innopreneurship platform's triple bottom line score (IPTBLS) can be derived using the weights in the following table.

In addition i, a reengineering economy score (RES) can be assigned to a smart city where i is the number of economic transitions achieved by that smart city. i will take a value between 0 and n where 0 represents a smart city that had not achieved a successful transition of its economy and n represents a city that had successfully achieved n

transitions of economy.

A Smart City Innovation Platform's score (SCIPS) can be computed using formula 1.

$$SCIPS = NIPS \times IPTBLS \times RES \quad --- (1)$$

Next section examines the role of key actors of a smart city's innopreneurship platform in its ability regularly to move its economy from one industry to the next.

5. SUSTAINABLE SMART CITY

A smart city can only qualify as a sustainable smart city if it is able to successfully move its economy from one to the next on a regular basis. A good example is the city of Lille which has established an ICT incubator called Euratechnologies by repurposing resources that had initially been used by the now defunct textile industry [Euratechnologies]. Such sustainability can only be achieved if Academic Institutions and Citizens are ready to respond in a timely manner to changes in technologies, markets, social developments and environmental concerns. Actions that can be taken by key actors are discussed in the following subsections.

5.1. Responsive Academic Institutions

Academic institutions should ensure that they are able to infuse and sustain innovation culture across all their stakeholders. This can be achieved by defining policies and corresponding programmes that are responsive to changing industrial landscape.

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The academic institutions should also develop curriculum that nurtures and strengthens the key traits required to be an entrepreneur — traits such as Creativity, Exploration, Resilience, Experimentation, Adaptability and Learning to learn (CEREAL).

Given that new industries may require additional new skills, academic institutions should offer programmes that help develop such new skills required by embryonic and emerging industries. Such programs should also help those working in mature industries and are willing to acquire the skills required to transition into an emerging industry. Academic institutions should be aware of the lead time required to produce skilled workforce for a new industry and hence have to carefully plan the launch of these programs to be in synchronization with the arrival of a new industry. This requires academic institutions to be lot more agile than at present.

Academic institutions should establish Innopreneurship related programmes to all their stakeholders. An example of such programmes is a progression of courses in innovation and entrepreneurship beginning with identifying market needs and wants, and ending with building a prototype of an innovation addressing those needs and wants. Other examples could include degree and non-degree programmes for those already employed in mature industries to transition into new industries including programmes that prepare individuals to become innovation managers and chief innovation officers.

Academic Institutions tend to be the slow to change. They often hang on to an old curriculum that has worked well. This is largely due to the fact that their faculty members themselves tend to focus on topics that they are familiar with, continuing to work in areas that they have established themselves. For academic institutions to stay relevant it is important to encourage and incentivise faculty members to evolve their research and teaching interests in alignment with emerging industrial trends and needs. It may also be important to provide disincentives for faculty members who continue to engage in topics that have become either outdated or irrelevant.

5.2. Innovative Citizenry

A smart city can sustain its leadership only when the critical portion of its citizenry are Innopreneurs. Innopreneurs who tend to be entrepreneurship minded innovation driven
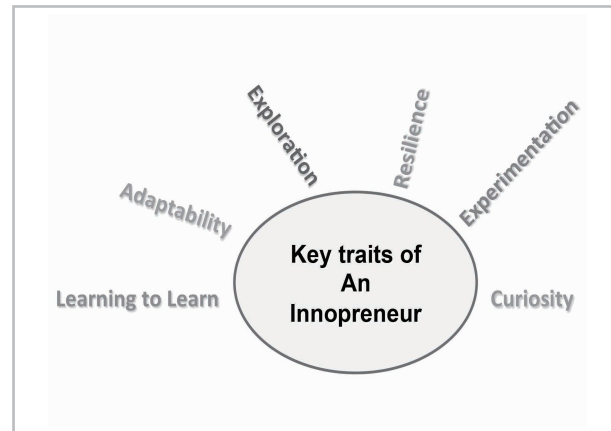

Fig. 6. Key traits of an Innopreneur

     Source: author

citizens tend to possess the traits presented in Figure 6.

Innopreneurs tend to be very curious. This curiosity gets them to learn how to learn about new topics. Their knowledge of new topics combined with curiosity explores new ideas for novel products, processes and services. Exploration is often followed by experimentation with their new ideas. Experiments help validate aspects such as feasibility, affordability and scalability. Some ideas will succeed and others will fail. Innopreneurs tend to dust off their failures and use the learnings from their experiments to adapt their ideas to meet market demands. Such a process is often referred to as pivoting. A smart city cannot sustain its current leadership if their academic institutions do not produce sufficient number of Innopreneurs.

All citizenry of a smart city have to accept the inevitability of change. It is well known that habits die hard and people hate change because change often makes their skillset irrelevant and forces them to compete with younger and more agile fellow citizens. Citizens who anticipate and embrace change by monitoring the sunset of their current industry and the rise of a new industry and proactively acquire skills required for the new industry, become critical assets for the continuing leadership of a smart city. We call this "Minds Future" a term that refers to a mindset that actively pursues and prepares individuals for the oncoming future. Such openness to changes can only be inculcated beginning a young age. It will be futile to expect those without such training in their younger years to transition from one industry to the next with ease.

5.3. Roles of other actors

Governments should and often do enact policies and programmes for managing changes at least for the purposes of their own survival if not for the betterment of their cities. They do have a choice of either pioneering such changes, fast following others who successfully responded to changes or do nothing. Smart city governments that anticipate and effect changes in industries and erect infrastructures to support such changes will enhance the possibility retaining its leadership.

Research labs should inspire citizenry about the oncoming changes and enumerate potential opportunities offered by embryonic and emerging industries. They should get individuals get future ready by acquiring relevant knowledge and skills.

Businesses, both large and small, should invest in a city's citizenry to help them embrace and prepare for changes. Their contributions can be at multiple levels. They certainly can establish academic chair positions for faculty who create changes, offer scholarships to students pursuing innovative curriculum and support Innopreneurship programs of all kinds including multi-tier competitions.

Investors should work closely with businesses to create companies for future industries. Investors such as Venture Capitalists should become "Venture Vendors" who will partner companies in creating their future business divisions in emerging industries using the "Spinning- In" concept practiced by CISCO (Bort, 2014).

All actors should collectively create a "nationwide / citywide" Innopreneurship ecosystem learning from tiered grooming practiced by soccer academies, classification system of International Chess federations classification, Weekly challenges of Hungarian Mathematics Academy, Apprenticeship practiced by Guilds and family involvement in little league games such as baseball.

6. SUMMARY AND CONCLUSIONS

The paper has provided a partial list of examples of the policies, programs and contributions of actors in a smart city innopreneurship platform. This is hopefully a useful starter list for those aspiring to build smart cities. It has also examined the key roles that academic institutions and citizenry should play in both aspiring and established smart cities in order to build and maintain a smart city. It has listed the key traits of an Innopreneur and has suggested some methods for creating Innopreneurs.

Some of the established smart cities have done well due a number of factors, key among them being supportive government, responsive academic institutions and innovative citizenry. However, as these cities mature they are bound to face a new set of challenges which may result in the migration of their Innopreneurs to greener pastures. Sustainable smart cities will be mindful of the naked truth - It is the innovative citizenry who can help maintain their leadership.

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