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Advancing the Hi-Tech Ecosystem in the Periphery: The Case of the Sea of Galilee Region

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***Abstract*—**There is a constant need for hi-tech innovation to be decentralized to peripheral regions. This work describes how we applied Design Science Research (DSR) principles to define what we refer to as the Sea of Galilee (SoG) method. The goal of the SoG method is to harness existing and new technological initiatives in peripheral regions to create a socio-technological network that can initiate and maintain hi-tech activities. The SoG method consists of a set of principles, a stakeholder network, and actual hi-tech business initiatives, including their infrastructure and practices. The three cycles of DSR, the Relevance, Design, and Rigor cycles, lay out a research framework to sharpen the requirements, collect data from case studies, and iteratively refine the SoG method based on the existing knowledge base. We propose that the SoG method can be deployed by regional authorities that wish to be considered as smart regions (an extension of the notion of smart cities).

***Keywords*—**Design Science Research, socio-technological initiatives, Sea of Galilee method, periphery stakeholder network, hi-tech initiatives.

I. Introduction

THIS work addresses the challenges of developing a technology ecosystem in peripheral areas. The goal is to provide regional authorities of peripheral areas with a method that combines the various stakeholders and initiatives into a coherent socio-technological ecosystem. Specifically, the goal is to present a method that allows stakeholder networks and expectations to be mapped in peripheral areas and that facilitates the emergence and expansion of hi-tech activities in these areas, thereby extending and densifying a region's hi-tech ecosystem. These activities are used to increase and deepen the connections between stakeholders and thereby render their network more stable and robust.

Hi-tech companies tend to concentrate in central geographical areas, frequently in urban metropolises (e.g., San Francisco, London, Beijing, Berlin) [1], [2]. This phenomenon has many advantages, both for the companies themselves and for the regional economy. The companies inspire each other with technological knowledge, exchange skilled human resources, and attract investors. This trend has grown in recent years due to (i) the increasing technological complexity that requires greater collaboration and (ii) the increasing attractivity of vibrant urban areas to workers. Currently, over 50% of global venture capital investment is concentrated in 10 urban metropolises [3].

Focusing on Israel, the technology ecosystem is concentrated predominantly in the Tel Aviv metropolitan area [1]. More than 60% of all hi-tech jobs in Israel are in Tel Aviv and the central region. As indicated in Fig. 1, approximately 77% of hi-tech companies in Israel operate in this area. This trend has intensified in recent years, with the growth in hi-tech employment in Tel Aviv constituting approximately 70% of the total increase in this sector in Israel [4].

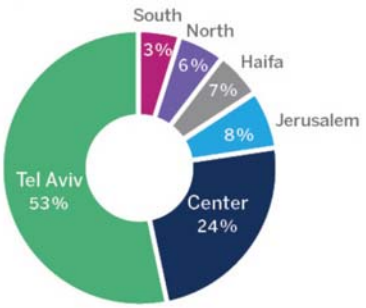

Fig. 1 Startups in Israel by region (2018) [4]

In parallel, the Israeli Innovation Authority encourages local entrepreneurship in peripheral areas via local entrepreneurship incubators [1]. These incubators promote the establishment of startup companies by local entrepreneurs through connecting them to the needs of local industrial, agricultural, and food companies, and to regional applied-research centers. The incubators thus contribute to the development of a local innovation ecosystem. Kon et al. [5] suggest that policymakers strive to create a fruitful environment that features hundreds of events per year in a small geographical region, typically a single city. These events could include lectures, workshops, conferences, informal meetings, social events, business, financing, marketing, etc. The authors note that currently, while Tel Aviv excels in this practice, other regions in Israel do not.

Several general questions arise when discussing the promotion of hi-tech industries in peripheral areas: How can we build upon the peripheral national anchors to create significant hi-tech business groups and companies? What operational activities are required to accomplish this goal? To respond to such questions, we first, explore an operational regional activity that encompasses an actual hi-tech activity that is a significant component of the SoG method, and second, measure how it affects the various stakeholders operating in the given peripheral area. The results of this approach lead us to suggest that the SoG method may be used by regional authorities to

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create policies that create *smart regions*, an extension of the notion of *smart cities*.

The contributions of this work include (i) the detailed SoG method that can be used in similar peripheral situations; (ii) the application of DSR to large-scale artifacts; and (iii) knowledge that can form the basis for further research work.

Sections II and III describe the research setting and the research method, respectively. Section IV is the main section of this paper, presenting the SoG method that emerges from this research. Section V applies the findings to extend the existing knowledge base, and Section VI concludes this work.

II. Research Setting

Kinneret Academic College is an Israeli higher education institution founded in 1965 on the southern shores of the SoG (also called Kinneret) [31]. Between 2004 and 2010, several engineering departments were founded in the college, including the Software Engineering Department in 2010. Students study for B.A., M.A., and B.Sc. degrees in the Faculty of Engineering and in the Faculty of Social Sciences and Humanities. Since its establishment, it has over 7000 alumni.

The college promotes a multicultural educational philosophy, social involvement, and continued development of the region. It serves a diverse student body through a combination of academic and nonacademic continuing-education programs. Further, the college fosters diversity and an intellectual environment, developing leaders who inspire future generations.

The main goal of the Faculty of Engineering is to train engineers in hi-tech fields and thereby contribute to the development of society and to the Israeli economy, particularly in the peripheral areas of Galilee, the Golan Heights, the northern and eastern valleys of Israel, the Jordan Valley, and the cities of Tiberias, Beit Shean, Katzrin, Hatzor HaGlilit, and Safed. The engineering education includes a strong foundation in the basic engineering sciences capped by knowledge in a specific engineering field, with an emphasis on complex and multi-disciplinary systems that involves training on engineering projects in collaboration with industry.

The Kinneret Innovation Center (KIC) was founded in 2018 as a partnership between the Kinneret Academic College and Zemach Regional Industries, Ltd., which is a cooperative owned by 27 agricultural communities in the Jordan Valley. KIC aims to attract new talent, ideas, entrepreneurs, investments, and enterprises to the SoG region, and to cultivate them. To create new economic advantages and rewarding employment opportunities in this northern region of Israel, KIC leverages the extensive assets of its founders, its strategic partners, and the agricultural heritage of the area. In addition to a physical space and rich historical context provided by its regional assets, KIC is building a thriving innovation community consisting of a mix of academia, established industry, international corporations, entrepreneurs, governmental and nongovernmental organizations, and investors. The interaction between members of this diverse community creates challenges and opportunities for collaborations that may lead to ground-breaking innovations in the center's main fields of interest which are agro-tech, water-tech, and food-tech. In addition, KIC leads a non-profit acceleration program in these fields, and maintains a forum of 60 chief executive officers (the CEO forum) of regional organizations. KIC thus provides a nurturing environment for startups who aim to transform Israel into a cutting-edge technological leader in these fields. Beyond ideas, KIC also connects people and provides a place for collaboration and developing new ideas.

In October 2020, the first author of this paper founded the *KIC Development Business Unit*, called KIC-Dev, which is a business unit in KIC. The main goal of KIC-Dev is to strengthen the cooperation between the Kinneret Academic College and KIC and to provide the college staff and students an infrastructure that facilitates interactions with the regional hi-tech ecosystem. We suggest that KIC-Dev has the potential to play a major role in the SoG method developed herein.

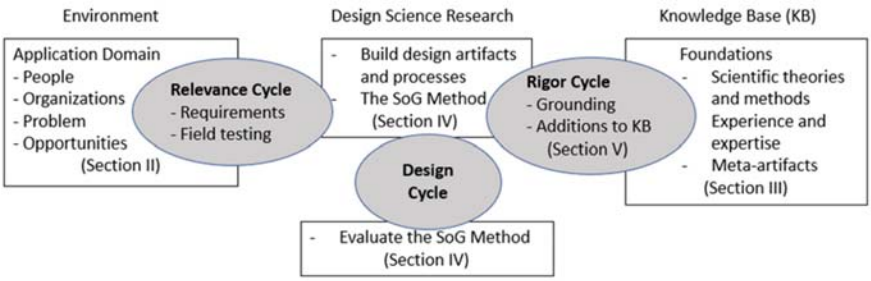

Fig. 2 Framework of DSR (including references to section numbers for elaboration)

III. Research Method

We adopted the DSR [6] principles to create the SoG method. According to Hevner [6], DSR embodies three closely related cycles of activities: the Relevance Cycle, Design Cycle, and Rigor Cycle. Fig. 2 shows the DSR framework with references to the appropriate sections of this paper.

Relevance Cycle: The first cycle is the Relevance Cycle, which involves defining the problem to be addressed, the research requirements, and the criteria for evaluating the research results.

In our research, we address the problem of a peripheral community that wishes to extend their hi-tech ecosystem (i.e., to increase the number and size of hi-tech companies operating in the area).

Since we focus on the establishment of development organizations, we define the following three requirements:

- (R1) Map the network of local stakeholders that own the resources required to create local hi-tech business activities.
- (R2) Create R&D groups that employ local college students, graduates, and senior developers.
- (R3) Establish a learning mechanism to improve continuously according to the evaluation criteria.

Table I shows the evaluation criteria, which are derived from the list of requirements and are determined through ongoing measurements.

TABLE I
EVALUATION CRITERIA FOR REQUIREMENTS

Req.	Evaluation criterion	Subjects of measurements
R1	Stakeholders ▪ Network attributes ▪ Resource utilization	▪ College management ▪ Innovation centers ▪ Local industry
R2	Development Projects ▪ Project metrics ▪ Level of engagement	▪ Students, alumni, and academic staff ▪ Local developers ▪ Customers
R3	Learning Mechanism ▪ Retrospective process	▪ Management of hi-tech business units ▪ College management ▪ Innovation centers ▪ Local industry

Design Cycle: The central Design Cycle of DSR involves the development and evaluation of artifacts and/or theories used to solve the identified problem. It iterates between the core activities of building and evaluating the designed artifacts and processes or theories [6].

In our case, the proposed artifact of the Design Cycle is the SoG method (presented in detail in Section IV). The core components of the SoG method are illustrated by the establishment and management of the KIC-Dev business unit. Specifically, the SoG method is evaluated and shaped in an ongoing process based on case studies of software development projects, each one developed for a specific customer of the KIC-Dev business unit.

Rigor Cycle: The Rigor Cycle refers to knowledge generation and use. Rigor is achieved by using foundations and methodologies from the research knowledge base, and contributing new research-generated knowledge [6]. We mainly utilize the literature on building hi-tech ecosystems and qualitative analysis of case studies. Important knowledge and experience have also been gained by the actual execution of the development projects described in the case studies that are part of KIC-Dev. Research participants include the KIC-Dev customers, development teams, and the management boards of the college and KIC. We use the notes of researchers and interviews to collect data.

IV. SoG Method

This work introduces the SoG method, which was developed based on existing literature and accumulated exploration of case studies, to address the challenge of creating hi-tech business activities in peripheral regions. The SoG method contains a systematic process that builds a technological ecosystem in peripheral regions by leveraging regional and governmental anchors, such as colleges and innovation centers. The SoG method stems from the Design Cycle of DSR conducted so far in two iterations in one year (from October 2020 to October 2021).

The SoG method is composed of (i) a set of principles that guide the ongoing process of maintaining and advancing hi-tech industry in peripheral regions; (ii) a stakeholder network that includes the various organizations and people that are part of the ecosystem in the region and the relationships between them; and (iii) a collection of actual hi-tech business activities that serves to retain stakeholders and add new stakeholders.

In what follows, we describe the SoG components: the principles (Section IV *A*), the stakeholder network (Section IV *B*), and one instance of a hi-tech business activity that is part of the SoG's collection of activities (Section IV *C*). This activity is the establishment and management of the KIC-Dev business unit. We use KIC-Dev to illustrate the two first components of the SoG method that prepares the groundwork for the KIC-Dev example. We also describe the evaluation of SoG Method (Section IV *D*).

A. Principles

The SoG principles can appear trivial in the context of promoting local hi-tech businesses in urban areas. However, when dealing with peripheral areas, these principles should be discussed on a regular basis (see Section v, which is based on previous work).

The first SoG principle is that t*he techno-social ecosystem should form a win-win situation*. In the case of KIC-Dev, the win-win situation for the ecosystem was first defined as the opportunity for college students and staff to engage in hi-tech development activities. This definition states that a project can be considered for development in KIC-Dev only if the development team has at least 50% of a regional footprint, meaning that at least 50% of the development team are stakeholders in the network that is detailed in Section IV *B*. After several months, this definition was extended to include the exposure to and the relationships with the regional CEO forum. The managers of regional organizations are now more aware of the advantages of outsourcing the development of their projects to KIC-Dev, when applicable. Four CEOs have already outsourced their development projects to KIC-Dev. Following one successful project, the Chief Information Officer of a local organization stated that "Now there is a way of working together with the hi-tech development division (KIC-Dev) in our region. We have another vendor in our vendor pool."

The second SoG principle is that *academic mechanisms should connect directly to hi-tech activities*. In the case of KIC-Dev, the college management agreed to allocate encouragement scholarships for students to be engaged in hi-tech activities.

The third SoG principle is to *convince regional business to emphasize hi-tech activities and companies over traditional industries.* In the case of KIC-Dev, the focus is placed on software projects, system projects, and projects that require data science skills. We note that, when KIC-Dev was established, no other company in the region offered the option to develop system and data projects. Furthermore, based on our data, hi-

tech companies in the area are not perceived as such by local stakeholders. Thus, work remains to be done to position correctly KIC-Dev and to increase the awareness of its existence and purpose.

B. Stakeholder Network

Establishing development business units involves several stakeholders. Table II lists the stakeholders for KIC-Dev and their expectations.

The list of stakeholder expectations led us to define a set of success criteria. Initially, we defined the following success criteria:

- Triple the number of software engineering students at Kinneret Academic College in four years.
- Increase the academic acceptance threshold to Kinneret Academic College' software engineering department by 15 points each year. As we progressed and improved our understanding of the demographic and social situation in peripheral regions, this specific success criterion was omitted since it was realized that a relatively low threshold for enrolment to academic studies is essential in the SoG peripheral region.
- Increase the number of graduates per year that remain in the area after graduation.
- Increase the number of local startups launched by alumni.

TABLE II
SOG STAKEHOLDERS AND THEIR EXPECTATIONS

Academia	Hi-tech industry	Other sectors
Kinneret Academic College ▪ Increase the number of students who study in the college ▪ Increase the number of students & alumni who live in the area ▪ Increase the number of faculty who are engaged in regional hi-tech activities ▪ Engage in regional hi-tech activities	Regional Hi-tech Organizations ▪ Increase number of regional hi-tech projects ▪ Rely on local human capital ▪ Increase cooperation with researchers & practitioners from the local College	Kinneret Local Municipalities ▪ Gain more funds for local initiatives ▪ Increase number of residents ▪ Increase the portion of young population
Kinneret Students ▪ Gain hi-tech experience ▪ Gain hi-tech jobs	Ecosystem ▪ Increase number of startups in the area ▪ Raise more funds for local startups	Tourism Industry ▪ Increase number of visitors ▪ Increase number of jobs
Kinneret Alumni ▪ Work in the region in hi-tech jobs ▪ Having opportunities to stay in the area after graduation	KIC ▪ Increase ecosystem activity ▪ Increase engagement with students & faculty ▪ Increase salary levels in the area	

C. Infrastructure and Practices for Projects

The establishment of a new business unit for development projects typically faces business, technological, and social challenges. It is important to mention that these challenges exist in any location, but are more significant and dominated in peripheral regions.

Challenges relating to business aspects address questions such as:

- Are some initial investments needed?
- Where will customers come from?
- Where will the developers come from?
- Why should customers trust us?
- What is the best suitable business model for KIC-Dev?

Technological challenges address questions such as: How can we maintain the development quality and continuous deliveries?

Social challenges address questions such as: How many developers from the SoG area currently work in the local hi-tech industry? Should KIC-Dev consider social criteria for accepting a development project? If yes, what are the challenges criteria? If not, why?

Answers to these questions addressed in the two first main phases that took place during the first year of research (October 2020-October 2021). The first phase was *the Encouragement Phase*, and the second phase was *the Pilot Phase*. In what follows, we describe these phases, using projects to illustrate the created infrastructure and defined practices of the SoG method.

1. Encouragement Phase

In the *encouragement* phase, we searched for projects and customers to start with, when no investment was available. We had the support of the KIC board of directors and management. At this stage, the most important support arrived from the college management, which agreed to allocate encouragement scholarships to students to enable them gaining working experience in hi-tech activities during their studies. We note that student work in parallel to their undergraduate studies is very common in Israel, especially in engineering disciplines [7].

Our first customer was located by a fourth-year software engineering student who lives in the area and knew a manager of a company which operates in the SoG area. The customer is a global company with 12 sites in Israel and abroad. The project includes building a unified vendor database that merges the databases from all company sites and provides an assessment and recommendation system for vendors to work with. This first project was developed in KIC-Dev by voluntary hours of the first author for the project management, and four students who receive encouragement scholarships provided by the college management.

The second project is a strategic project that is still under development that has the potential to become the future R&D unit of the customer's company to be located in the SoG area. The project includes the development of an advanced learning management system that provides educators the ability a) to build and edit content and b) to view and guide educational activities based on an artificial intelligence engine that analyzes learning and teaching data. The customer of this project was found by an experienced educator who lives in the area and who worked with the customer's platform. This customer is from the southern periphery of Israel, which faces the same challenges as the SoG area located in northern Israel. This customer selected KIC-Dev for three reasons: a) the recognized expertise of KIC-Dev management in the product domain, b) the

immediate access of KIC-Dev to the college academic staff for their expertise in the project domain and c) the immediate access of KIC-Dev to students for future employment in the northern branch of the customer's company. These criteria are in line with the customer's declared goals to "cooperate with academia in order to develop a business and make a social impact in Israel and the US."

With respect to infrastructure and practices, we selected the Monday tool as the infrastructure for KIC-Dev management and for agile management of projects [8]. This tool enables a communication channel for KIC management for most of its activities, such as managing the pipeline of potential customers and following up on existing projects, vendors, and personnel. For example, Fig. 3 shows the Monday GUI for managing the different projects according to their status, and Fig. 4 shows several columns used to manage the Active Projects.

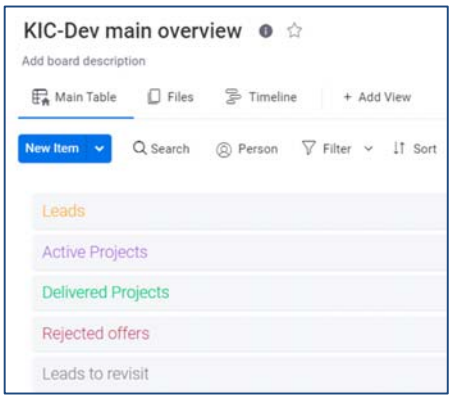

Fig. 3 Monday screen for projects' overview

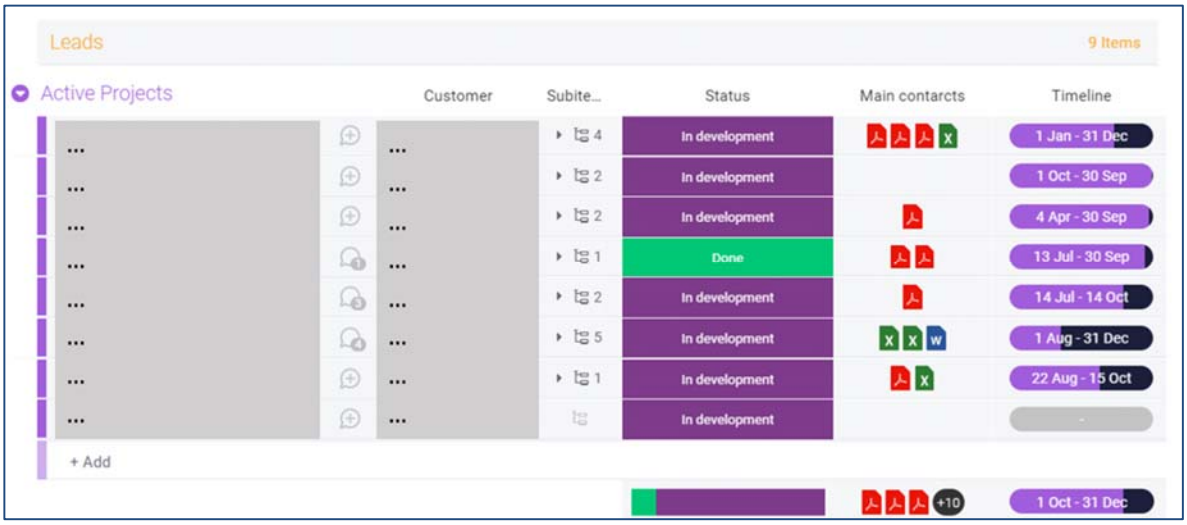

Fig. 4 Monday screen for maintaining active projects

For each project, we use business management boards that help us keep customer relationship and/or development boards that utilize the Agile methodology [9] implemented at KIC. Fig. 5 illustrates iterative task management, and Fig. 6 shows details of one development iteration, where the board columns used for project management and follow-up.

The practices we use are derived from the Agile set of principles, which suit the characteristics of the development unit. We defined a business model that satisfies the needs of our stakeholders and customers. This model involves *two-week development iterations* in which the customer approves the tasks of each iteration before the next iteration starts, meets the senior development team every week to ensure alignment, and provides feedback for the delivery at the end of the iteration. Every month (i.e., after two iterations), if the customer approves the development products, the project continues. Every three months (fiscal quarter), we conclude a business phase by facilitating retrospective activities, reviewing project's scope towards the planning sessions of the next phase, and performing financial transactions from the customer and to the vendors. The goal of this process is to reduce the business risk.

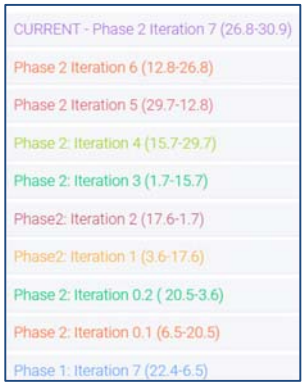

Fig. 5 Monday screen showing development iterations

The main practice that we establish during the encouragement phase is *team empowerment*. We initiated the creation of development teams for each project, with each team composed of senior and junior developers and software engineering students. In most cases, the students and junior

developers who are members in KIC-Dev teams say "I feel I'm not alone" and "I appreciate the self-confidence I gain".

Following our win-win principle described in Section II, we consider the expectations of as many stakeholders as possible while building the teams, which enables us to propose an attractive business offer and to construct a professional group that can launch software engineering students into the world of hi-tech development. We suggest that the classic model whereby students work directly with hi-tech employers (see, e.g., [7]) is difficult to deploy in non-centralized areas like the SoG region due to socio-economic parameters such as ethnicity, income, and parents' education [10], [11]. Therefore, given our peripheral situation, we create an environment in which experts in both software development and management can provide mentorship.

Fig. 6 Monday screen for task management

2. Pilot Phase

After a few months of work, we convinced the KIC board of directors that the SoG method should be further explored and, specifically, that KIC-Dev should complete its pilot stage until the end of the fiscal year 2021. In the *pilot phase*, our goal is to convince potential customers in the SoG region to work with us. For this purpose, we launched two initiatives: The first was called *North4.0* that aimed at projects relating to industry 4.0 and, specifically projects such as data harvesting and predictive maintenance. We have today one customer in this initiative.

The second initiative is called *North stays at the North* that encourages customers to keep their construct development budget in the SoG area, rather than moving it to other areas in Israel or abroad. Today, three customers have joined this initiative. During this phase, we strengthen the relationships with local organizations and improve the definition of their role in the stakeholder network.

While increasing the number of projects and consequently the number of developers, vendors, and students involved, we continue increasing the awareness of KIC-Dev in the college. This approach led to a development project received from one of the faculty members, who had a budget for the development of a mobile application for multilingual professionals. At the end of the academic year, we recruited two graduates, who live locally, as developers. Finally, a collaborative marketing activity was established between the college and KIC-Dev.

D. Evaluation of SoG Method

Table I presents the criteria for evaluating the extent to which the SoG method addresses three requirements (Section III). Below, we evaluate how the SoG method addresses each requirement by using measurements and the results associated with each requirement, based on a qualitative analysis of the data collected during the two design cycles.

1. (R1) Map the Network of Local Stakeholders that Own the Resources Required to Create Local Hi-Tech Business Activities

The evaluation of the first requirement considers the network attributes and resource utilization.

The implementation of the SoG method involves a diverse network of over 60 organizations based in the SoG region and with a clear incentive to promote the regional hi-tech ecosystem. Although we succeeded in increasing awareness of KIC-Dev and its activities, efforts should be invested in exploring the connectedness of the network entities as well as potential ways for collaboration. After one year of operation, we find that we met some of the stakeholders' expectations (that are described in Table II):

- 18 students acquired hi-tech experience. This mainly answers the expectation of Kinneret Students, and can in the long term answer the expectations of the Kinneret Academic College and Kinneret Alumni.
- Two faculties are engaged in KIC-Dev projects. This answers the expectations of the Kinneret Academic College and the Regional Hi-tech organizations.
- Two alumni obtained freelance jobs. This answers the expectation of Kinneret Alumni.

- Nine development projects were managed for customers, six of them for local industry. This answers the expectations of various stakeholders in the academia, hi-tech industry, and other sectors.
- The time spent by students on innovation-center activities was increased tenfold. This answers the expectation of KIC.

In addition,

- Resources allocated by the college and the innovation center were used to support KIC-Dev activity. Based on interviews with participants, most of the senior practitioners see themselves as pioneers due to their involvement in bringing hi-tech activities to the region.
- The value proposition for the main stakeholders is constantly discussed. Since KIC-Dev is an initiative that is characterized as a bottom-up initiative rather than a top-down strategy, the stakeholders are still learning the value of the SoG method. In the second year of operations, we plan to improve the framing of the KIC-Dev initiative.

2. (R2) Create R&D Groups that Employ Local College Students, Graduates, and Senior Developers

Evaluating the second requirement requires considering the project metrics and engagement level.

In its first year, KIC-Dev obtained seven development projects and completed two projects. The customer organizations vary from education, consulting, food, and agriculture to cyber-physical systems. Interviews with customers, who represent the industrial pool of stakeholders, show that they relate to the social aspect of KIC-Dev and that they are proud to be part of it. One of the customers said, "This is about two organizations—us and KIC—that bring academic knowledge and practical experience, each in its domain, together with an agenda to strengthen the periphery and announce that innovation emerges here. An excellent combination between our characteristics and agendas."

3. (R3) Establish a Learning Mechanism to Improve Constantly According to the Evaluation Criteria

Evaluating the extent to which the third requirement was satisfied includes measurements of retrospective processes [9], [12].

The iterative manner of the SoG method, which derives from the iterations of the business activity of KIC-Dev, provides an ongoing retrospective process that considers the SoG stakeholders, customers, and development teams.

After one year of applying the SoG method, the college management uses it for marketing, the customers conceive KIC-Dev as colleagues with shared vision, the local senior developers are happy to have a new hi-tech center, and the students learn the advantages of teamwork and experience working with customers. One student who graduated at the end of the year said, "Experiencing hi-tech activity as a student while studying gave me the confidence that I can cope with it. I graduate with more experience and knowledge related to things that are not learned in academia. Before I worked and experienced it, I didn't know what I was capable of." Another student said that she "learned how to deal with a project and how to plan it, manage the process, work with customers, solve problems, deliver a project, and many more things!" One of the customers said that "there are no customers and vendors here, but rather cooperation among experts and friends along the way."

V. Extending the Knowledge Base

This section is the result of the Knowledge Base Stage of DSR. We review some of the literature related to the context in which the SoG method can be applied. We focus on literature that deals with implementing digital transformation, smart solutions, and innovation processes in regions, towns, and rural areas. We further examine urban areas and the concept of smart cities because technology is at the core of such initiatives, and we aim at bringing them to peripheral areas.

According to Forrester, the smart city uses information and communication technologies to increase awareness, interactivity, and efficiency of the critical infrastructure components and services of a city: administration, education, healthcare, public safety, real estate, transportation, and utilities [13]. A smart city or a smart town is an innovation ecosystem empowering the collective intelligence and co-creation capabilities of user or citizen communities [14]. With respect to stakeholder involvement, towns have an advantage over cities because they are smaller in terms of size and population, and typically enjoy a denser network of citizens and community relations [15]. Existing work shows that the notion of smart regions is used as an extension of smart cities and towns aiming for ecosystem growth and increased innovation [16]-[18].

In such regions, public services, such as higher education, on which we focus herein, is an example of where smart solutions are required. Educators and administrators recognize the power of new technology for improving efficiency and effectiveness of academic institutions [19]. They are increasingly interested in leveraging new technologies to both increase access to educational content and improve collaboration between students and faculty. In the context of the SoG method, we refer to the cluster of cities, towns, and villages in the region as the "smart SoG region." One of our main stakeholders is the college management which, after one year, sees KIC-Dev as an engine to increase local hi-tech presence and to motivate scholars, and considers KIC-Dev as a sort of *glue* for creating stable connections within the stakeholder network.

Research regarding towns in the digital age is in its early stages and is immature, with digital technology remaining a niche topic in studies about rural areas [20]. Hosseini et al. [21] describe the challenges to consider when implementing smart solutions in towns—among them is the importance of considering the local context, ensuring the involvement of local stakeholders, and identifying suitable technological solutions.

Cities and towns are entities that can be regarded as an overarching system of stakeholders [13]. A study of seventy cities investigated the role of several context variables (e.g., economic, urban, demographic, and geographical variables) and their impact on the development of smart cities [22], found that the evolution of smart cities depends largely on the local

context. Barca et al. [23] highlight the importance of place-based approaches for regional development and argue that contextual details, such as social, cultural, and institutional characteristics, play crucial roles. Still, they note that policies should also be people-based when we wish to foster innovative ideas through the interaction between insiders and outsiders and thereby support regional development efforts. For the SoG method, the network of stakeholders and the associated relationships is an essential component of the method and, based on our experience in the first year of KIC-Dev operation, the relationships between stakeholders enable to meet the challenges.

There is no one-size-fits-all approach that can ignore the context [24]. The various types of cities and regions impose their own terms for innovative activities and processes. Understanding the context and identifying the specific needs of an area are important steps, following the priorities that should be set for actions based on the overall development plan of cities and regions and their vision for innovation [25], [14], [19]. Although understanding the context already constitutes a major challenge when implementing smart solutions in cities and regions, it becomes even more relevant and difficult when addressing peripheral regions [26]-[28].

The digital development of towns by means of applied innovation depends, to a large extent, on its local context (e.g., economy, geographical variables, density of population, and other specific factors) [22]. Towns therefore require stronger guidance to understand the relevant context and define appropriate strategies [21]. Zygiaris [25] reports that citizens and communities form human engines that must engage constructively with the relevant stakeholders and strive to attain high levels of community participation. The roles of participants during innovation processes create the bonds and dependencies and enable the development of smart projects [29], [30]. We need participants who can become leaders to initiate and maintain the smart city transition [25]. The leaders should strive to minimize competition and conflicts between stakeholders [13]. In this vein, the SoG method strives to grow the future leaders of the SoG area who will take the next steps to advance the region.

In general, any smart city or region depends on the appropriate and meaningful application of digital technologies to community life [21], [13], [15], [26]. Once the context of the city or region, with its specific characteristics, strengths, and weaknesses, has been scrutinized and understood, the "smart" dimension becomes a key factor in creating problem-solving processes and smart solutions. In this regard, digital technologies can be seen as important prerequisites. However, without the full engagement and collaboration of the relevant stakeholders, no smart solutions can emerge [15], [19]. In the case of the SoG region and based on the work of the first year, our goal in the second year of KIC-Dev operation is to extend the research on the connectedness and the *glue* notion aforementioned of the stakeholder network.

The common mismatch between technology orientation and the actual needs of cities is a major obstacle on the road to smart cities [14]. Despite the diverse and individual challenges of cities, smart-city solutions emerge in most cases by technological vendors, rather than by an administrative pull [13]. Furthermore, smart cities and towns that are part of regions must be able to evaluate and monitor the potential benefits of partial solutions while keeping an eye on the bigger picture. The challenge is to assess smart ideas and technologies and to understand which ideas may prove most effective in fulfilling the needs of citizens, users, and other stakeholders [19], [26], [28]. In the case of the SoG method, we actually "push" technology into the area by providing more hi-tech business activities, and we evaluate the method from three perspectives: stakeholders, the development projects, and the learning mechanisms.

VI. Summary

In this work, we propose the SoG method, designed to be deployed in peripheral regions to advance the regional hi-tech footprint. The focus of the SoG method is the stakeholder network and the initiation of hi-tech business activities.

In the second year of this research, we will explore: a) the notion of *glue* which connects stakeholders and b) the repercussions of the business aspect on the major stakeholders.

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