

Scenario Planning for Establishing Water, Energy and Food Nexus-Driven Open Living Labs in Lebanon and Jordan

Original
Article

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ABSTRACT

Establishing a sustainable WEF-NEXUS Open Living Lab (NDoLL) requires creative navigation of future opportunities and risks that might positively or negatively affect its operation. This article shows how to conduct effective scenario planning to explore future factors that might underpin or undermine the effective operation of the NDoLL in supporting ecosystem stakeholders in the Mediterranean area, covering two case examples: Jordan and Lebanon. The results show that, in Jordan, the most critical focal issues that will affect NDoLL's operations are Entrepreneurs' Interest and Engagement and Access to the network within the ecosystem. The economic situation and business regulatory framework will cast high uncertainties on those two issues. On the other hand, in Lebanon, engagement and participation of WEF ecosystem stakeholders and financing of NDoLL represent the key focal issues. Those two factors are likely susceptible to uncertainties imposed by political instability and economic stagnation.

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INTRODUCTION

WEF Nexus

The WEF nexus refers to the interconnectedness of water, energy, and food systems. The Mediterranean region faces several challenges related to the interconnected systems of Water, Energy and Food (WEF), including water scarcity, energy dependency, and food insecurity (Bieber et al., 2018; IPCC, 2022). The NEXUS concept seeks to optimize such interlinked relations among the three sectors and improve the overall efficiency's usage of resources (Okonkwo et al., 2023). Water scarcity is a significant challenge in the Mediterranean region, with many countries facing water stress and droughts. The agricultural sector is the largest consumer of water in the area, putting a significant strain on water resources. The management of water resources in the region needs to be improved, and water-saving technologies and practices need to be promoted to ensure sustainable water use (Bazzana et al., 2023). The energy sector in the Mediterranean region is heavily dependent on imported fossil fuels, and This dependency makes the area vulnerable to fluctuations in global energy prices and supply disruptions. Promoting renewable energy sources and energy efficiency measures is crucial for reducing energy dependency and promoting sustainable development in the region (Ghinolfi, El Baz et al. 2014, Ramadan, Radwan et al. 2019). The food sector

in the Mediterranean region faces several challenges related to food security and self-sufficiency. Many countries in the region rely heavily on imported food, and the agricultural sector is vulnerable to climate change and water scarcity (Tanyeri-Abur, 2015). Promoting sustainable agricultural practices and developing local food systems can help address these challenges and promote regional food security. The WEF nexus approach recognizes the interconnectedness of these systems and aims to address the challenges in a holistic and integrated manner (Okonkwo et al., 2023). By promoting the sustainable management of water, energy, and food systems, the Mediterranean region can improve its resilience to climate change and other external shocks, promote sustainable development, and improve the well-being of its population.

WEF-Living Labs

The living Labs approach emerged to improve public management behaviour and increase rationality in the decision-making process (Fuglsang and Hansen, 2022). The approach is concerned with creating value and generating benefits for the broader group of stakeholders, particularly end users (Imset, Haavardtun and Tannum, 2018). This value creation is achieved through a collaborative, participatory, and iterative process involving co-design, implementing, and evaluating solutions (Hronszky and Kovács, 2013). The process typically includes several stages, including problem identification, solution design,

testing and implementation, and evaluation and learning (*Leminen and Westerlund, 2016*). Therefore, the essence of Living Labs as an approach is to provide a space and a method for involving ecosystem stakeholders, particularly citizens, earlier into the innovation process for exploring challenges and solutions collaboratively and allowing for experimentation in a real-life context before investing in implementing final solutions (*Afacan, 2023*). Involving stakeholders is likely to boost positive perceptions of the process and ensure the quality of output and results (*Logghe and Schuurman, 2017*). The Living Labs approach has been applied in various contexts, including urban and rural areas and has been used to test innovative solutions such as sustainable agriculture practices, renewable energy systems, and water management technologies (*Leminen and Westerlund, 2016*).

Against this background, WEF Living Labs could be defined as a collaborative experimental space for ecosystem stakeholders, where the WEF solutions are co-developed, tested and implemented on the real-life ground to demonstrate the potential of these solutions in promoting sustainable development. WEF ecosystem's stakeholders refer to individual or group who can affect or is affected by the operations of the Living Labs. Therefore, identifying and involving all relevant stakeholders in complex open innovation processes may be complicated, costly and challenging, considering the uncertainty in the early stage of the process.

METHOD: SCENARIO PLANNING

In the literature, panels have been presented as one helpful method for handling stakeholders (*Schuurman, Marez and Ballon, 2016*). Still, the applications seem limited to processes focusing on end users. *Imset, Haavardtun and Tannum (2018)* argued other stakeholders might be more critical, in the earliest stages, to the chances of success. While the involvement of different stakeholders is crucial for success, it brings other additional uncertainties to the establishment and the implementation living labs' activities. Therefore, exploring the future driving forces of uncertainty at the macro level and building operational scenarios is intrinsic for securing the sustainability of living labs. We chose to apply the Scenario Planning Method presented as the basis for an initiative to establish a living lab around the WEF Nexus ecosystem in Jordan and Lebanon (for the sake of the space and reducing redundancy, results from Lebanon will be presented in the Appendix).

The scenario planning method is helpful for organizations or individuals facing high levels of uncertainty and complexity, such as emerging technologies, geopolitical instability, or climate change. It helps to broaden thinking about the future, challenge assumptions, and identify blind spots. Organizations or individuals can better prepare for unexpected events and develop more resilient strategies by considering a range of possible futures.

The scenario planning method typically involves the following steps:

1. Identify the key focal issues and driving forces: Identify the critical factors that will shape the future, such as technology, demographics, economics, and geopolitics.
2. Evaluating driving forces according to the level of uncertainty and choosing the most critical forces
3. Develop scenarios: Develop multiple scenarios that reflect different possible futures based on various combinations of driving forces. These scenarios should be plausible, internally consistent, and challenging.
4. Evaluate scenarios and Develop strategies: Evaluate each scenario based on its potential impact on the organization or individual, identifying opportunities and risks associated with each scenario. Develop a robust strategy under a range of possible futures, considering the opportunities and risks identified in each scenario.

RESULTS

Case 1: Scenario Planning for WEF-NDoLL in Jordan

To run a scenario sprint, a virtual workshop was held on August 21, 2022, gathering 11 national WEF experts, entrepreneurs, and researchers to identify the focal issues of implementing NDOLL's supporting strategies in the Aqaba area - Jordan, where the Living Lab will be located. The moderators were already well-trained on how to run a scenario sprint following a predesigned method. The following section shows how the scenarios evolved and corresponding strategies were created to cope with future uncertainties.

Step 1: Identify the key focal issues and driving forces

Key focal issues

In this step, participants worked individually to identify the focal issue/challenges of implementing NDOLL's strategies. The identified focal points are collectively represented in (Figure 1) below.

Low interaction with stakeholders
Entrepreneurs not interested or engaged
Stakeholders do not represent added value
Limited researchers participation
Sustainability after end of the project
Need for online/physical model choice
Need for success stories
Need for access to experts
Need for significant infrastructure
Need for positive stakeholders engagement
Need for training programs
Need for a location that is in proximity to the ecosystem
Need for access to network within the ecosystem

Fig. 1: Challenges for implementing NDOLL's strategies

Then, participants voted on the most challenges, believing that entrepreneurs' interest and engagement and access to a network within the ecosystem are the most critical challenges that need to be overcome.

Key Driving Forces

After identifying the most critical focal issues/ challenges for implementing NDOLs, participants started doing a PESTLE analysis to describe them by defining driving forces that affect such issues in the future. (Figures 1,2) illustrate the PESTLE analysis of the two cases.

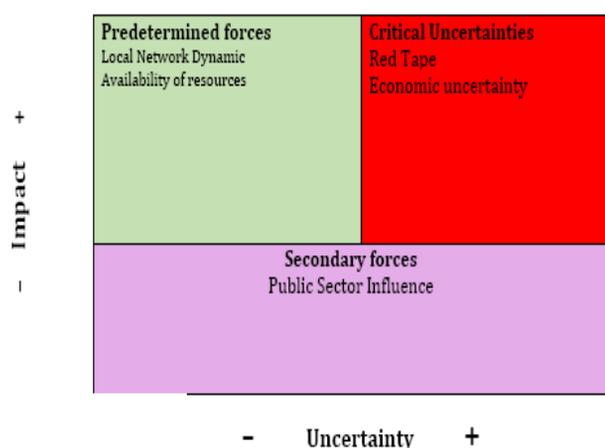


Fig. 2: Impact & Uncertainty Matrix

Clustering driving forces that have a mutual impact on each other

Some defined forces were similar to each other and were refined and given a specific name. In collaboration with the participants, the moderator refined and grouped forces that would be beneficial in clearly leading the discussion towards the next step. (Tables 1,2) show the clustering of the driving forces for each of the two identified focal issues.

Table 1: Sources of driving forces that might affect engagement and interest of entrepreneurs

Focal Issue 1: Entrepreneurs' Interest and Engagement			
Driving forces	Political	Economical	Social
	- Unstable / change of legislation - Taxation laws	-Economic employment opportunities available - Too much economic uncertainty may inhibit entrepreneurship	- Fear of failure - Consumer Trends
	Technological	Legal	Environmental
	- Entrepreneurs need specific technical infrastructure which is not available	- Lack of understanding of the different legal liabilities of starting a company - Entrepreneurs need a vocational license	- Availability of natural resources

Table 2: Sources of driving forces that might affect having access to the network within the ecosystem

Focal issue 2: Access to the network within the ecosystem			
Driving forces	Political	Economical	Social
	- Rivalries within the network - Central control and influence in the public sector - Subsidies for programmes	- Economic incentives for participation - Availability of skilled labour	- Calling in favours can exhaust opportunities for worthy entrepreneurs - Fear of association with donor programmes - Effect of disclosure
	Technological	Legal	Environmental
	- Availability of R&D facilities/ programs	- Restrictions within public sector engagement - Material import/export	

After clustering the PESTLE driving forces for each identified issue, the moderator and the participants condensed the two issues' driving factors into a single

Table 3: Clusters of Driving Forces of Entrepreneur’s Engagement and Interest

Focal Issue 1: Engagement and Interest of Entrepreneurs	Driving Forces clusters
	Business environment
	Cost of opportunity of entrepreneurship
	Economic uncertainty
	Need for specific infrastructure
Availability of natural resources	

Table 4: Driving forces of access to a network within the ecosystem after clustering

Focal issue 2: Access to the network within the ecosystem	Driving Forces clusters
	Public sector influence
	Local network dynamic for a small community
	Fear of harmful exposure for public figures
	Availability of resources
Red Tape	

Step 3: Developing scenarios

Expected Negative and Positive Outcomes

This step is dedicated to building up a battery of positive and negative expected outcomes that the future behaviour of each defined critical uncertainty might trigger. These factors will be used for developing multiple scenarios

Table 6: The extreme outcomes of defined driving forces

Uncertainties			
Economic Environment		Red Tape	
Group A Positive Outcomes	Group B Negative Outcomes	Group A Positive Outcomes	Group B Negative Outcomes
- Job availability - National and international interest in the local market - Markets growing - New market opportunities - Higher chances of having access to opportunities	- Very high unemployment - Absence of investments - Weak markets with no buyer power - Fewer opportunities, whether it is investments, clients, or access to resources	- No need for licensing - Simple corrective actions - Simple regulations - Governmental entities involving entrepreneurs in problem-solving exercises	- No chance of licensing - High fines for non-conformity - Legal liability - Lack of communication between the government and the ecosystem
Description		Scenario Name	
Scenario A-A Opportunities abound for existing and new ventures competing in new and growing markets while governmental entities are involved in actively helping entrepreneurs and SMEs solve problems and create value.		Abundant opportunities	
Scenario B-A Opportunities are taken by those capable of circumventing red tape, with start-ups losing out.		Loss of start-ups	
Scenario A-B Limited opportunities create a drive for innovative business models harnessed and supported by the public sector.		Limited opportunities	
Scenario B-B The fragile economic environment that is not producing economic opportunities for businesses and people is exasperated by a heavy burden of regulations that kill whatever opportunities remain.		The world is ending.	

location. (Table 3) illustrates the clustered driving forces of the focal issues of implementing NDOLL's strategies.

Step 2: Evaluating driving forces according to the level of uncertainty and choosing the most critical forces

After clustering and condensing the driving forces, participants voted for the two most impactful and highly uncertain clusters Using the Impact & Uncertainty matrix (Tables 4,5). We found the Red Tape and Economic uncertainty, as shown in Figure 2 below

Table 5: Clustered driving forces of focal issues

Clusters of Driving Forces for successful implementation of NDOLLs	Red Tape
	Public sector influence
	Availability of resources
	Economic uncertainty
Local network dynamic for a small community	

that reflect different possible futures based on various combinations of driving forces. These scenarios should be plausible, internally consistent, and challenging.

In this activity, participants defined two extreme groups of outcomes for each of the two most uncertain driving forces, as shown in (Table 6)

After identifying the positive and negative outcomes of the most uncertain driving forces, participants identified KPIs for the outcomes of each of the uncertainties as follows

Develop Scenario Themes

Participants explored interactions of the most uncertain and essential drivers, representing divergent and plausible scenarios depicted in (Figure 3) below.

Step 4: Evaluate scenarios and Develop strategies

After Identifying these scenarios, participants brainstormed to identify the potential impact of this scenario on the future implementation of NDoLL's supporting strategies. In this regard, strategic actions are identified as NDoLL responses to seize future opportunities and mitigate risks WEF ecosystem stakeholders face. as shown in (Figure 4).

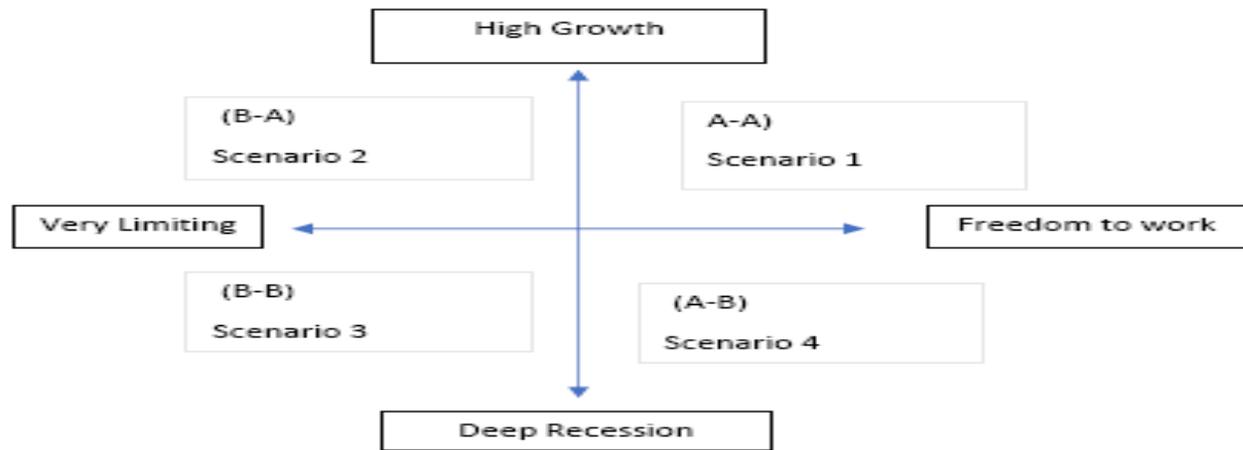


Fig. 3: 2X2 Matrix Scenarios

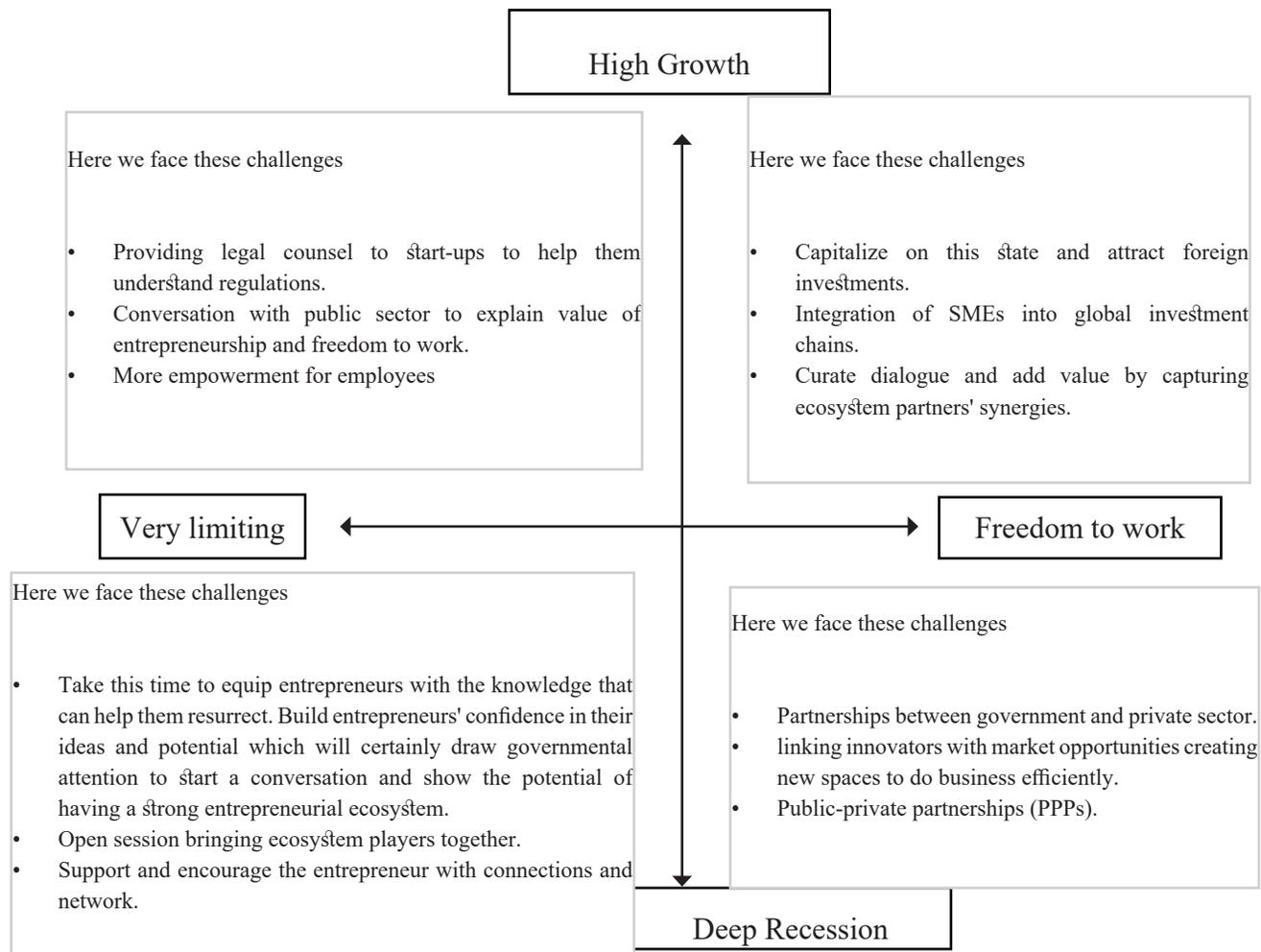


Fig. 4: Challenges and Responses 2X2 Matrix Scenarios

DISCUSSION

In this article, we used the scenario planning method to explore future challenges, opportunities, and driving forces that might affect the implementation of WEF-NDoLL's supporting strategies in Jordan and Lebanon (*Radwan 2018*). The results demonstrate high similarities between both countries. Engaging WEF ecosystem stakeholders in collaborative innovation processes represent a common critical challenge in both countries. Access to networks and finance is also a common challenge in both countries. In Jordan, bureaucracy, regulatory environment, and economic performance are the most influential driving forces that impose various uncertainties on the future operations of NDoLL. While the WEF living lab might be affected by these challenges, it can also provide services to mitigate them and support ecosystem stakeholders. In this context, WEF Living Lab can:

- Provide legal counsel to start-ups to help them understand regulations
- Establish conversation platforms with the public sector to explain the value of entrepreneurship and freedom to work.
- Provide a space for bringing ecosystem players together, support and encourage the entrepreneur with connections and network.
- Linking innovators with market opportunities creating new spaces to do business efficiently.

In Lebanon, according to the experts who participated in the scenario sprint workshop, the most likely scenario is the worst scenario: Political instability and lack of access to funding. In this context, WEF-NDoLL should focus on the following domains to support ecosystem stakeholders

Regulation and Policies

- Advocacy and support towards new regulations in terms of Water, Energy, Food Nexus

Projects and Innovation

- Support entrepreneurs by conducting feasibility studies
- Piloting the projects to filter innovation and keep the trust of investors
- Collaboration between academia and business and potentially government (at least in-kind assistance, talent sharing from businesses, etc.)
- A legal framework to benefit from government data (data on irrigation and weather from LARI, etc..)

Technical Assistance and Expertise

- Joint programs for technical assistance
- Relying more on tech to provide data

- Data sharing platforms

Financial Strategy

- Developing Financial Instruments related to the activities

- Creating a strong strategy to reach out to donors
- Create trust among investors
- Developing cross-border partnerships
- Collaboration between academia and business and potentially government (at least in-kind assistance, talent sharing from businesses, etc..)- potentially funding by businesses

Citizens and Community

- Creating value for citizens through the Living Lab
- Create short and long-term benefits to increase the commitment of user-engagement

ACKNOWLEDGEMENT

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CONFLICTS OF INTEREST

There are no conflicts of interest.

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الملخص العربي

تحليل وبناء السيناريوهات المختلفة لإنشاء مختبرات الابتكار المفتوحة لمعالجة مشكلات رابطة المياه والطاقة والغذاء في لبنان والأردن

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إقامة مختبرات قائمه علي مفهوم الابتكار المفتوح لمعالجة المشكلات الخاصة بتداخل مجالات المياه والطاقة والغذاء يتطلب تحليلاً دقيقاً للواقع، وذلك بناء تصوراً إبداعياً لفهم الفرص والمخاطر المستقبلية التي قد تؤثر إيجاباً أو سلباً على عمل هذه المختبرات. في هذه الدراسة نوضح كيفية بناء السيناريوهات المختلفة لعمل مختبرات الابتكار في المستقبل، وذلك باستكشاف المتغيرات التي قد تدعم أو تقوض عمل هذه المختبرات وتؤثر سلباً أو إيجاباً على قدرتها على دعم أصحاب المصلحة في قطاعات المياه والطاقة والغذاء في منطقة البحر الأبيض المتوسط. وتركز الدراسة على كلا من الأردن ولبنان. تظهر النتائج أن أبرز العوامل التي قد تؤثر على عمل مختبرات الابتكار المفتوحة في الأردن هي "مدى اهتمام ومشاركة رواد الأعمال في أنشطة مختبرات الابتكار" وكذلك "مدى القدرة على التنسيق بين المكونات الداعمة للابتكار في التداخلات البيئية لمجالات المياه والطاقة والغذاء". وستلقى الحالة الاقتصادية، والأطر التنظيمية للأعمال بمزيد من عدم اليقين والمخاطر المرتبطة بهذين العاملين. من ناحية أخرى، في دول جنوب البحر المتوسط، يمثل "مدى مشاركة أصحاب المصلحة في تداخلات المياه والطاقة والغذاء في دعم أنشطة مختبرات الابتكار"، وكذلك "مدى توافر تمويل مستدام لمختبرات الابتكار المفتوحة" أكثر العوامل التي قد تؤثر على فاعلية المختبرات مستقبلاً. وسيضيف كلا من عدم الاستقرار السياسي والتباطؤ الاقتصادي مزيداً من عدم التأكد والمخاطرة المرتبطة بهذين العاملين.

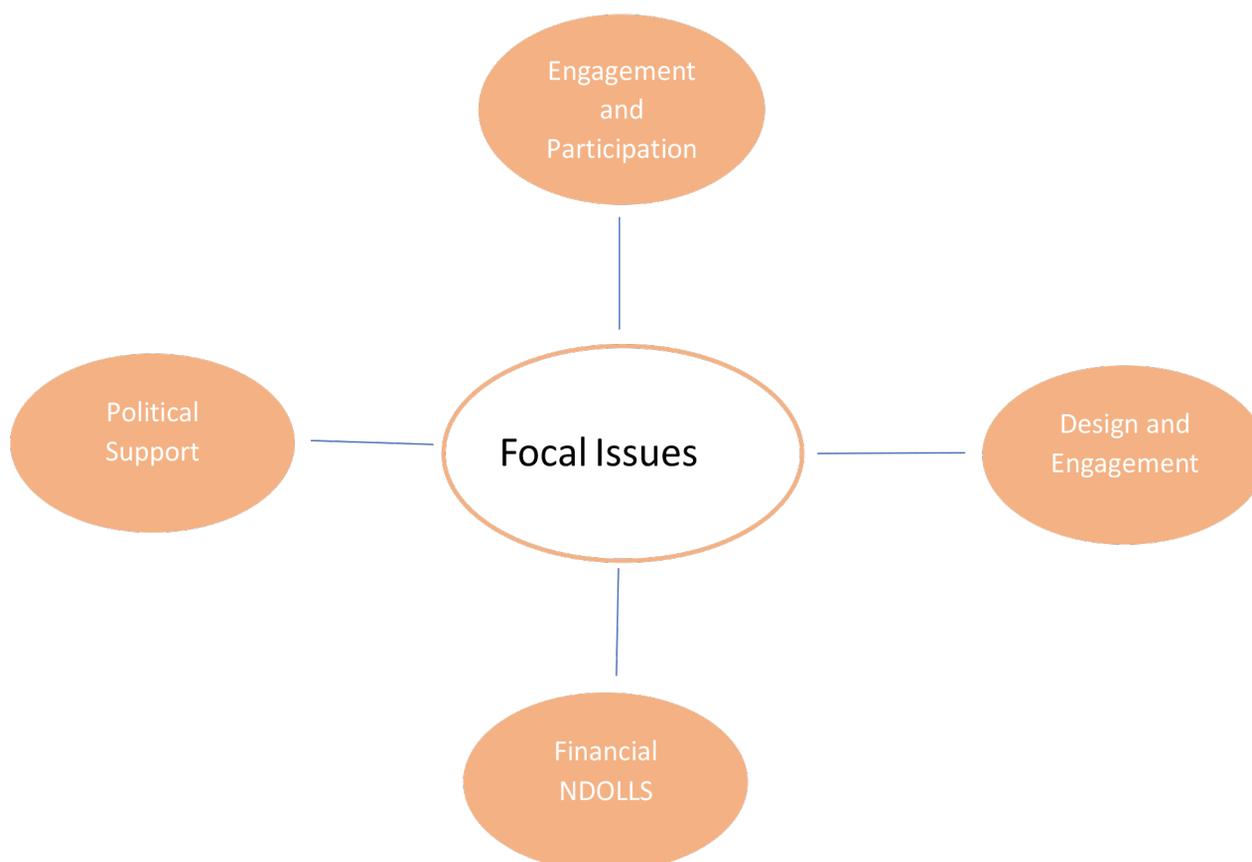
Appendix

Case 2: Lebanon: NDoLL scenario building Activity Description

As part of WP3 "Landscape identification for clustering scenarios evaluation to implement NDOLLs in MPC", the output O3.4 "Creation of physical and virtual environments to match NEXUS innovation demand and offer" aims at establishing one cross border NEXUS-driven Open Living labs in Lebanon, where scientific, industry, society and business communities can work and innovate together by matching demands of innovation and offer of technological solutions. Under Output 3.4, the official launch of the living lab was organized in Berytech, Mar Roukoz Premises, on June 7, 2022. The event gathered 20 stakeholders coming from NGOs, academia, entrepreneurship, and the public sector in the field of WEF-NEXUS to discuss the strategy for developing a sustainable NEX-LABS Living Lab that tackles the challenges faced in Lebanon in the WEF sectors. The event included a circular conference (Output 4.5) on the NEXUS Challenges and Opportunities, followed by the Scenario Planning Workshop (Output 3.3), and finally, an entrepreneur's corner space (Output 4.8) and networking opportunity over lunch.

Step 1: Identify the key focal issues and driving forces

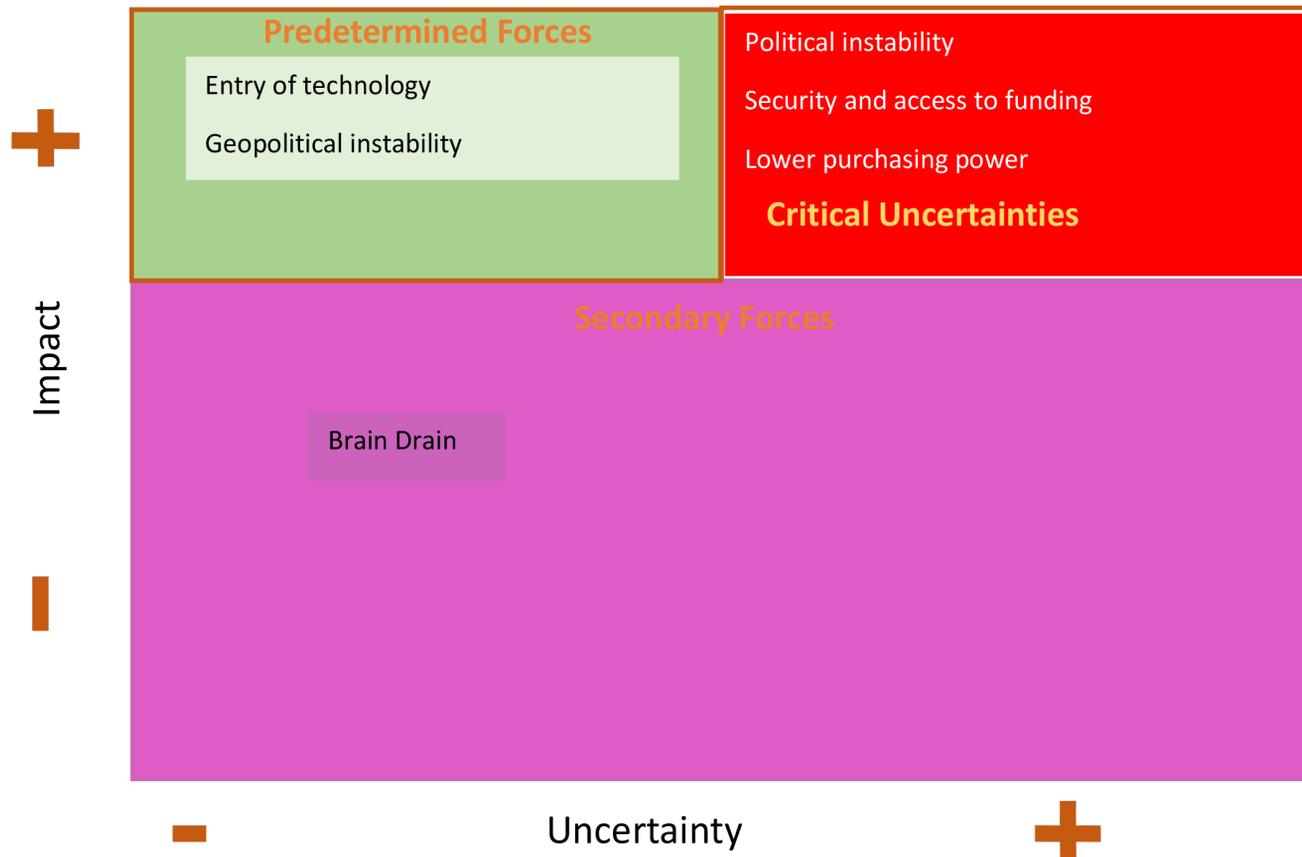
1.1 key focal issues



1.2 Key Driving Forces

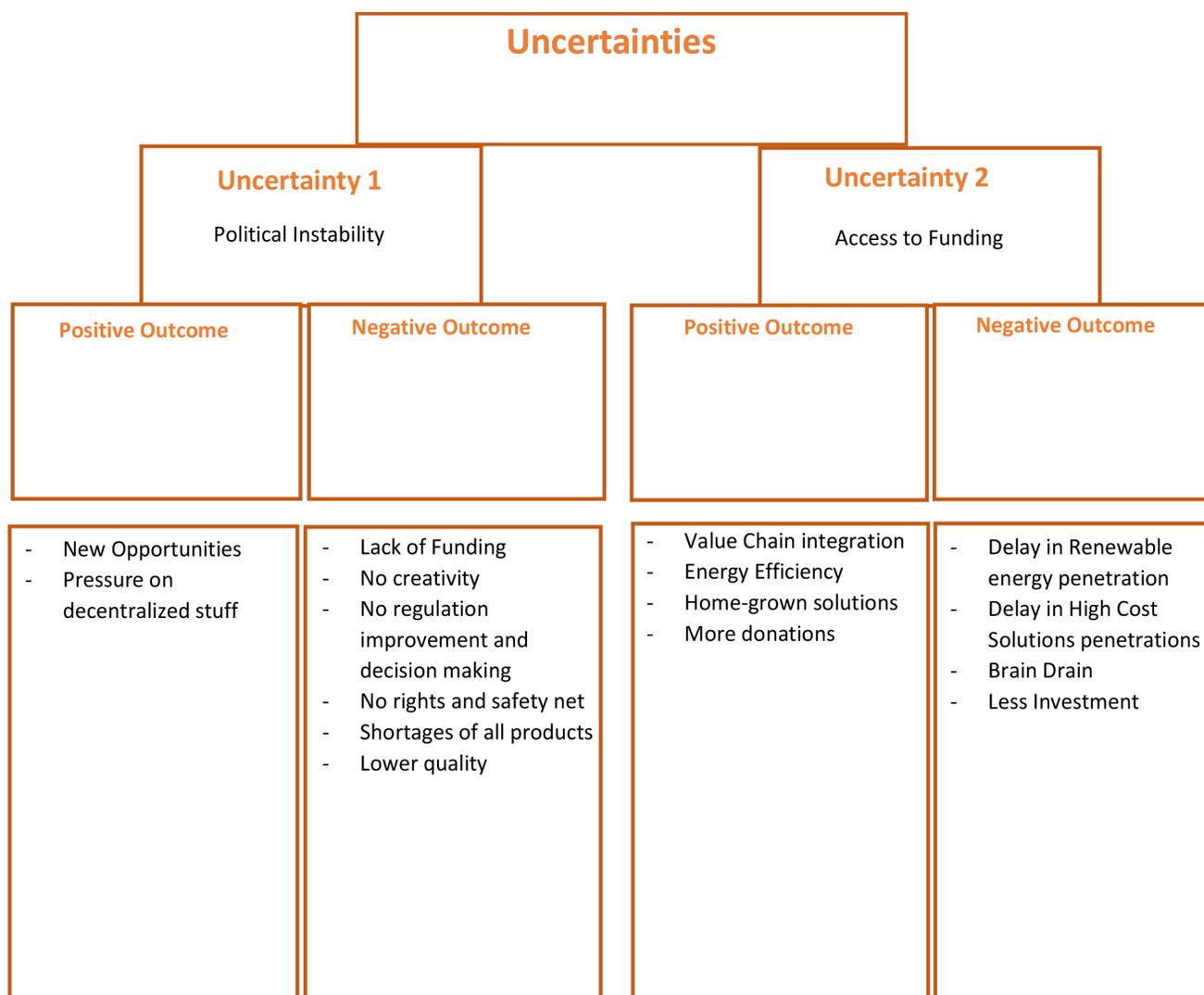
Future implementation of support alternatives to NDOLs facing NEXUS challenges			
Driving forces	Political	Economical	Social
	Lack of laws and Regulations (Decentralized RE law pending) Stability Lack of governance (corruption) Geopolitical Tension Formation of Government and instability Lack of Law enforcement (cancellation of exclusivity)	Economic Crisis Access to finance/funds Currency deprecation Inflation Cash basis economy No mechanism for funding environment solutions (like Wastewater Treatment)	Tensions and competition between refugees and Lebanese Absence of social Security Unfair practices Lack of awareness of new Tech. Inequality in distributing services (water quality and access to water/elect.) Gender issues - Brain Drain Outsourcing Gvt Functions (like Waste management)
	Technological	Legal	Environmental
	Inability to import High-tech products in Lebanon (like sensors) due to strict regulations and embargo Homegrown-environmental solution are increasing No database for technological input providers for prototypes Low collaboration between academia, businesses, and Gvt. Lack of awareness towards new technologies Brain-Drain	Lack of governance and law Enforcement and embargos National production is not a priority in Lebanon Unfair competition	Pollution Lack of circularity Land degradation Climate Change Degradation of air, water and soil quality Lack of environmental awareness

Step 2: Evaluating driving forces according to the level of uncertainty and choosing the most critical forces

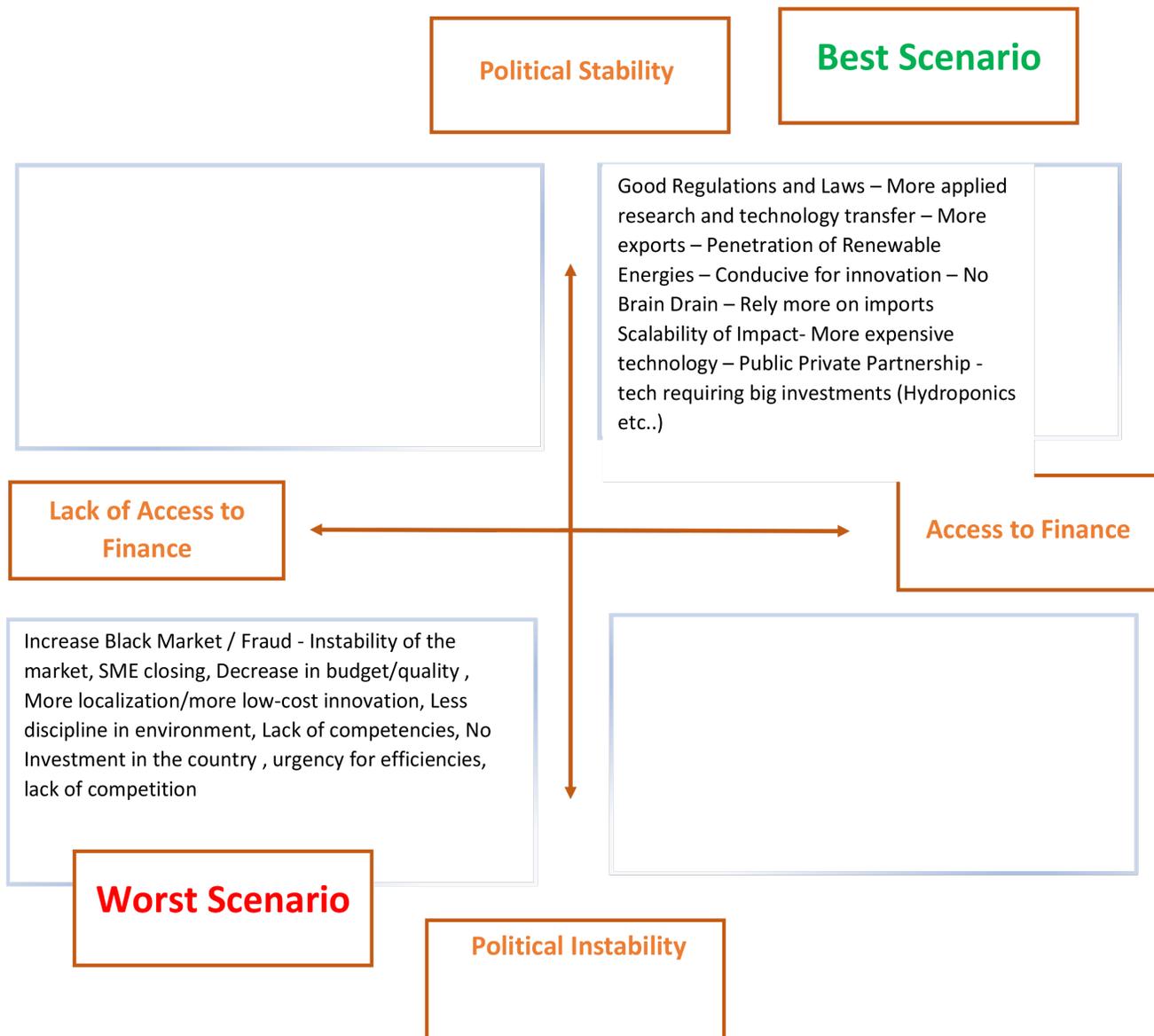


Step 3: Develop scenarios

3.1 Expected Negative and Positive Outcomes



3.2 Develop Scenario Themes



Step 4: Evaluate scenarios and Develop strategies

