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Implementing the systemic approach supporting territorial resilience: the case of the ‘Toile’ tool

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Abstract—We are in an era of change, where climate, health, social and economic emergencies can no longer be ignored. Faced with the extent of these transitions, territories are in the front line. Through this paper, we will see what role territorial resilience plays in the regulation of territories in times of crisis and/or brutal shocks such as the Covid19 health crisis. As the main aim of this paper is to shed light on the factors of territorial resilience, we will then describe the different indicators that contribute to the approach to territorial resilience. Finally, we will establish the relevance of a systemic approach within this family of factors favoring territorial resilience. To do this, we will study the case of the Dunkirk territory and its systemic representation via the ‘Toile’ tool proposed by the Flanders-Dunkirk Region Urban Planning Agency (AGUR).

Keywords—Resilience of territories, Indicators, Systemic approach, the ‘Toile’ tool.

I. INTRODUCTION

In view of the numerous transitions and transformations that our societies have been facing over the last twenty years, the concept of territorial resilience is developing and is now a solid concept for overcoming future disturbances in a territory. Resilience, originally promoted by ecologists, has gradually become a universal and transversal concept that can be applied to any discipline via socio-ecological, economic and spatial systems. Its definition has largely evolved through its uses. This paper will refer to Holling's (1973) definition of resilience as a measure of the persistence of a system, i.e. its capacity to absorb changes and disturbances while maintaining the same relationships between its state variables. Holling no longer defines the resilience of a system as a return to equilibrium. Stability is no longer an ideal [1]; the system responds positively to external stimulus, adapting its structure to change, while maintaining its initial trajectory [2].

What about territorial resilience? In this paper, we will shed light on the definition and the place given to this concept in the literature. Then, we will look at one of the major obstacles to the development of resilience, i.e. its relative nature, even subjective, which requires permanent vigilance and the use of several specific indicators, mainly in the territorial context. Indeed, although several factors seem to have been identified and to contribute to the resilience of territories, there is still no consensus on universal indicators for measuring resilience, which are considered too reductive and risky [3].

Following a review of the state of the art of territorial resilience indicators, we will see the added value of a systemic representation of a territory that can compensate for the limitations of point indicators of territorial resilience. We will illustrate our reflection through the analysis of a systemic representation tool of the territory developed by the Urban Planning and Development Agency of Flanders-Dunkirk Region (AGUR) in France.

II. CONCEPTUAL FRAMEWORK

A. Territorial Resilience: a literature review

In contrast to the widely revisited general term of resilience, territorial resilience is a complex subject that is still little discussed in the literature, as it has been emerging crescendo over the last ten years in parallel with the current challenges facing our society. Indeed, although the notion of territorial resilience has acquired a definition, its analysis remains abstract, subjective and limited to particular case studies, since there are no universal, strictly objective criteria for measuring this territorial resilience [4].

A resilient territory can be defined as a complex system in motion, capable of anticipating sudden or slow disturbances, mitigating their effects, recovering and rebounding proactively [5] thanks to the three fundamental principles of resilience: adaptation, learning and innovation. A resilient territory must constantly strive towards a new state in 'dynamic equilibrium' collectively constructed and maintaining its functionality. Thus, the resilient system or territory possesses capacities of reorganization and renewal favoring its sustainability. Therefore, resilience, in addition to being an operational crisis management strategy, can allow a system to move towards an ideal of sustainability. In the case of territories, this would facilitate their transition towards sustainable development in correlation with current and future complex contexts [6].

A resilient system does not aim to prevent disaster but to achieve sustainable functioning through dynamic processes that consider its ecosystem. According to Le Blanc [9], resilience is a response to uncertainty that requires greater reactivity and flexibility than other strict risk prevention approaches, such as the vulnerability approach, although the two remain linked and complementary.

In short, the process of resilience allows territories to deal with, and sometimes even anticipate, these rapid transformations and to integrate them in a sustainable way. More specifically, it enables them to adopt a forward-looking approach to bring out strategic lines of development such as those linked to their dependencies (energy, food, water, etc.), their threats (risk of flooding, economic collapse, etc.) or even their opportunities (circular economy, citizen participation, sustainable governance, etc.) A resilient territory should then be able to take up complex challenges, simultaneously addressing different fields such as economy, agriculture, ecology, politics and sociology, in the medium and long term.

B. Point indicators of territorial resilience

In the previous sub-section we showed the key position that resilience holds in the development and maintenance of our territories. Nevertheless, this notion of resilience remains relative in view of the absence of universal and objective indicators.

Indeed, it is complicated to propose a universal method for measuring the resilience of a territorial system (spatial, organizational and human) because of its specificities and complexity. Despite this, the emergence of work relating to indicators or factors of territorial resilience has continued to grow over the last ten years. Using a wide range of databases (Cairn, ScienceDirect, Google Scholar), covering a broad spectrum of publications from double-blind papers to practitioner work, we draw up an analysis table explaining the different indicators of territorial resilience and their parameters (Table 1).

We were able to determine a framework describing the nature of the changing characteristics between indicators such as their objectivity, their resilience status, etc.

- Nature of the indicator (N): Quantitative (Q), Qualitative (Qua); Subjective (S); Objective (O); Direct (D); Indirect (IN)
- Characterization of resilience (TR): Collapse (C); Type 1 preventive (T1); Type 2 proactive (T2)
- Level of genericity (G): Territory-specific indicator (I); Universal indicator (or applicable to any type of territory) (U)

While some of the reading criteria seem explicit, such as the subjectivity and objectivity of territorial resilience indicators, others appear more complex, such as criteria D, IN and TR. The definitions of these criteria are available below.

A resilience can be studied in a direct way (D) if the system has been resilient in the past or in an indirect way (IN) if the system tends to be resilient in the future [10]. In terms of criteria for characterizing resilience (TR), there are three types:

- Collapse, which represents the least resilient state since it is analogous to the phenomenon of avoidance frequently leading to rupture or even regression.
- Type 1 of resilience, also known as preventive resilience, which expresses the ability of a system to mobilize the necessary energy to return to a state of equilibrium prior to a shock.

- Type 2 of resilience, or proactive resilience, which expresses the ability of a system to mobilize the necessary energy to get through the crisis and find a new equilibrium that breaks with the previous situation [11].

TABLE I. ANALYSIS OF TERRITORIAL RESILIENCE INDICATORS TABLE

Ref. (Year)	Name of the indicator	N	TR	G
[12] (2007)	Phase portrait (with measurement of the size of the basin of attraction, the depth of the attractor, the precariousness) NB: Technical difficulty of implementation	Q, O, D	T2	I
[11] (2010)	The Strategic Resiliency Scoring tool or SRS	Qua, S, D	T1	I
	CICERO Model (Centre for Investigation and Experimental Research in Organizational Resilience)	Qua, S, D	T2	I
	CRC Model (Crisis – Resilience – Change)	Qua, S, D	T2	I
[9] (2013)	Measurement of the processes of participation, negotiation and information on a territory via analyses: - The circulation of information - The quality of territorial anchoring - Indicators of trust and knowledge of the territory	Qua, S, IN	T1 or T2	I
	Quantitative indicators of the evolution of the territory such as: indicators of urban compactness, redundancy of networks, etc.	Q, O, IN		I
[3] (2014)	Vulnerability approach - demographic such as: ageing population, net migration rate, etc.	Q, O, IN	T1	I
	Vulnerability approach - environmental: climate change, accelerated biodiversity loss, resource scarcity, increasing environmental health risks, etc.	Qua, S, IN	T1	I
	Vulnerability approach - social via the poverty line, unemployment rate	Q, O, IN	T1	I
	Vulnerability approach - social via the social and functional mix	Qua, S, IN	T1	I
	Vulnerability approach - economic: economic dependence of the territory	Qua or Q, S, IN	T1 or C	I
[2] (2015)	A stochastic Model via reversionary parameters	Q, S, D	T2	U
[13] (2015)	Evaluation of space - society - environment interactions	Qua, S, IN	T1 T2	I
	Cohesion of spatial entities	Qua, O, IN	T1 T2 or C	I
[6] (2017) [14] (2018)	Analysis of the conditions for successful anticipatory monitoring	Qua, S, IN	T2	U
	Analysis of capacities to act and respond (including spatial and temporal scales)			

	Analysis of interactions between actors			
[15] (2018)	Territorial Capital: equal to the regional endowment of structural territorial assets identified as carrying the development of the places	Q, O, D	T1 or C	I
[10] (2018)	« Input Indicators » Measurement of resources (e.g., number of people working on a project or costs)	Q, O, D	T1 or C	U
	« Output Indicators » Measurement of what has been produced (Example. The length (in metres) of the new flood barrier)	Q, O, D	T1 or C	U
	« Result Indicators » Measurement of the results achieved (e.g. evacuation time of a city in case of a storm)	Q, O, D	T1 or C	U
	« Process Indicators » Measurement of when and how the actions were implemented	Q or Qua, O or S, D	T1 or C	U
[16] (2019)	Technological approach	Qua, S, IN	T1	I
[17] (2020)	The Baseline Resilience Indicators for Communities (BRIC) [18] (2014)	Q, O, D	T1 or C	U
	The Spatial Decision Support System Model (DS3) [19] (2018)	Q, O, D	T1 or C	U
	Resilience Capacity Index [20] (2012)	Q, O, D	T1 or C	U
	The PEOPLES Resilience Framework [21] (2010)	Q or Qua, O, D	T1 or C	U
[22] (2021)	Composite index of territorial resilience (TRI) coupled with a cooperative Lotka-Volterra mathematical model	Q and Qua, O, IN	T2	U
[23] (2021)	Spatial Decision Support System (SDSS) NB: Notion of transformative resilience	Q or Qua, O, IN	T2	U

The recent emergence of reflections and questioning on universal indicators, since the analysis of the majority of indicators identified as universal appear in publications dated less than five years ago and in particular in 2021 - in correlation with the health crisis of 2020.

The low proportion of type 2 indicators reflecting the proactive potential of a territory in terms of its resilience, i.e. its capacity to get through a crisis and find a new state of equilibrium that breaks with its previous situation. In fact, the collapse and preventive type 1 indicators are still in superiority and reflect the lack of anticipation, actions and prospecting that can accompany the territory towards resilience before the risk of a shock is noted.

The nature of the indicators is varied; the Quantitative and Qualitative criteria are similarly represented, the same goes for the Subjectivity and Objectivity criteria, only the Direct and Indirect indicator criteria show a significant difference (D: 14; IN: 9) which confirms the previous point (i.e. the population of C and T1 indicators is in the majority →

illustration of a territory that has been resilient in the past and is currently in the process of preventing a new crisis).

Although the sample panel could still be enlarged, it already sheds light on the overall trends of territorial resilience indicators: their nature, their scope, their limits, etc. Following these initial observations, we will highlight the limits of the indicators presented above.

C. Limits of territorial resilience indicators

One of the fundamental limitations of territorial resilience indicators has already been widely discussed, namely the non-universal nature of most of them. Indeed, according to some authors [3] [10], territorial resilience cannot be standardized through general indicators, on the contrary, each territory should compose its own family of indicators (a long and tedious concept for territories). However, recently other authors [17] are in favor of the idea of establishing a universal reference framework for measuring territorial resilience.

Finally, as territorial resilience requires a multidimensional and complex field of study, the use of several complementary indicators is recommended to capture as objectively as possible all the quantitative and qualitative variables. The use of several indicators makes it possible to consider the entire ecosystem in which resilience is growing. Indeed, the systemic approach consists in taking into consideration the globality of a complex system, its interactions and dynamics. For this reason, we are attempting to observe how the systemic approach fits in with the notion of territorial resilience and what relevance it has as a complement to the indicators used to measure resilience.

D. The systemic approach supporting territorial resilience

The notion of resilience does not initially come from the systemic field. However, the dynamic and circular representation offered by a systemic representation models the phenomenon of territorial resilience in a more realistic way, previously thought of as linear and causal. The evaluation of degrees of territorial resilience via indicators generally focuses on too few variables and therefore simplifies reality, i.e. the complexity of a territorial system between spatial, human, economic and environmental issues, etc.

In systemic logic, the 'cause' did not 'produce' what is happening. In other words, the 'cause' is not responsible for the consequences, but it causes the system to react in a certain way. In most cases, despite the system's ability to act, it is unable to regain its previous state of equilibrium and must reach a new state of equilibrium that is distant from the previous one; this is what is known in systemic terms as the ability to regulate through feedback loops. This principle of regulation is at the heart of the concept of resilience since a system reflexively tends to maintain or regain its state of equilibrium.

The systemic approach is therefore necessarily integrated into territorial resilience discussions because of its very definition. Indeed, the systemic approach consists of considering the entirety of an ecosystem and makes it possible to go beyond sequential methods based on the successive analysis of elementary indicators. Because of its systemic representation, it also makes it possible to translate, communicate and disaggregate the complexity of a system, which is essential for understanding the dynamics of a territorial system [6].

Through these observations, the systemic approach seems to be an alternative capable of overcoming the limits of indicators and other measuring tools of territorial resilience and, through its field of representation, to become a lever for territorial resilience [26]. Several authors use the term of systemic resilience [12], [27] which can be summarized in four aspects:

- 1) *a circular and dynamic vision* of the notion of resilience, initially thought of as a linear and causal phenomenon due to a one-off crisis;
- 2) *applies to a living, complex system in interaction with its ecosystem*. It deals with the entire ecosystem without sequencing;
- 3) *in its relationship with the environment*, the system under study may be subject to certain disturbances that lead it to a new state far from its norm. Then the system must be able to react and operate, in a logic of functioning by feedback loop, regulation mechanisms or behaviors allowing it to find a stable and comfortable state;
- 4) *the systemic nature of this resilience offers the potential for visual representation*, enabling the complex nature of the system to be translated into strategic development axes. These diagrams can show, for example, the interactions between actors in the system, their dialogues, etc.

Based on these definitions, and in particular the last statement referring to the schematization of the complex character of a territorial space, we will explain the facilitation of the integration of a systemic resilience in a territory through an innovative tool: the 'Toile' of the Urban Planning Agency of Flanders-Dunkirk Region (AGUR). We will use this tool and its role in fostering territorial resilience in Dunkirk. This tool, in the form of a spider web, offers a simple systemic reading of the local ecosystem.

III. A CASE STUDY APPROACH

A. Presentation of the territory

The territory of Dunkirk is characterized by the presence of an industrial-port complex, situated in a dense environment of neighboring conurbations, within a cross-border coastal area. This territory has undergone periods of transition and transformation that mark its identity. It is marked by heavy industrialization, resulting from the French indicative planning policy, following the Second World War, and generating environmental, social and economic difficulties. The territory had to face industrial decline resulting in factory closures, a rising unemployment, a loss of attractiveness, a marked social distancing, a complex ecological transition, etc.

How can this fragmented territory be revived, reconverted and revitalized? Isn't this what territorial resilience being all about? To be able to go through a crisis by absorbing disturbances and variations in order to finally find a new state of balance favorable to the development of the territory. This is where the importance of the actors in the territory involved in its restructuring comes into play; in the case of Dunkirk, the Flanders-Dunkirk Region's Urban Planning and Development Agency, is actively involved in this issue in close collaboration with the Dunkirk Urban Community as

well as the major actors in local development. Over the years, several dynamics have been developed in Dunkirk to promote territorial resilience. These include the emergence of participatory projects [9], social actions such as free buses, the implementation of industrial symbiosis [30], and the creation of new tools such as the 'Toile' tool.

B. Research design

We selected an "extreme single case study because we are following an original initiative that has no equivalent in the French regulatory context [31]. This case is also a 'theory testing case studies' to assess the validity and scope conditions of the systemic approach supporting territorial resilience. Thus, based on the literature analysis presented above, but also on field observations through visits (of energy structures, historical museums presenting the territory, industrial centers, etc.) and about ten workshops with actors involved in the 'Toile' project tool (energy experts, industrialists, territory professionals, elected representatives, etc.), we will try to understand the role of the 'Toile' tool in supporting and strengthening territorial resilience in Dunkirk. These workshops, which took place at the beginning of 2020 at the AGUR, are of different forms: discussion on the use of the tool, points to improve, involvement of new actors, etc.

At the same time, ten surveys, conducted during 2020, with territorial experts from other territories and occasional users of the Toiles, were carried out using semi-directive methods. The objective here was to study the transferability of the 'Toile' tool to other territories (interest, feasibility of reproducibility, etc.)

The interviews were organized around a set of predetermined open-ended questions, allowing for other questions to emerge from the dialogue with interviewee. The framework of these interviews was defined beforehand according to the steps listed below and oriented according to the profile of the interviewee (sociologist, urban planner, territorial engineer, researcher, ordinary citizen, etc.):

- Stage 1- Brief presentation of the context of the study: organization carrying out the study (AGUR), questions raised about territorial resilience indicators.
- Stage 2- Presentation of the 'Toile' tool, exchange on the functionalities of the tool, its uses within the local ecosystem, its improvement tracks (e.g. digital and dynamic version), etc.
- Stage 3- Open questions: Could the 'Toile' tool be integrated in your territory? If so, in response to what needs, for what uses? Would it be able to support your territory in its transformations? To what extent would it impact or facilitate the evolution of the role of territorial organizations? How would it fit in with collaboration and cooperation approaches?

Following the Yin approach [29], we made a triangulation with all these data to describe and understand the observed phenomena and the use and contribution of this new reading and action tool for territorial actors (companies, entrepreneurs, local governments, institutions, associations, etc.).

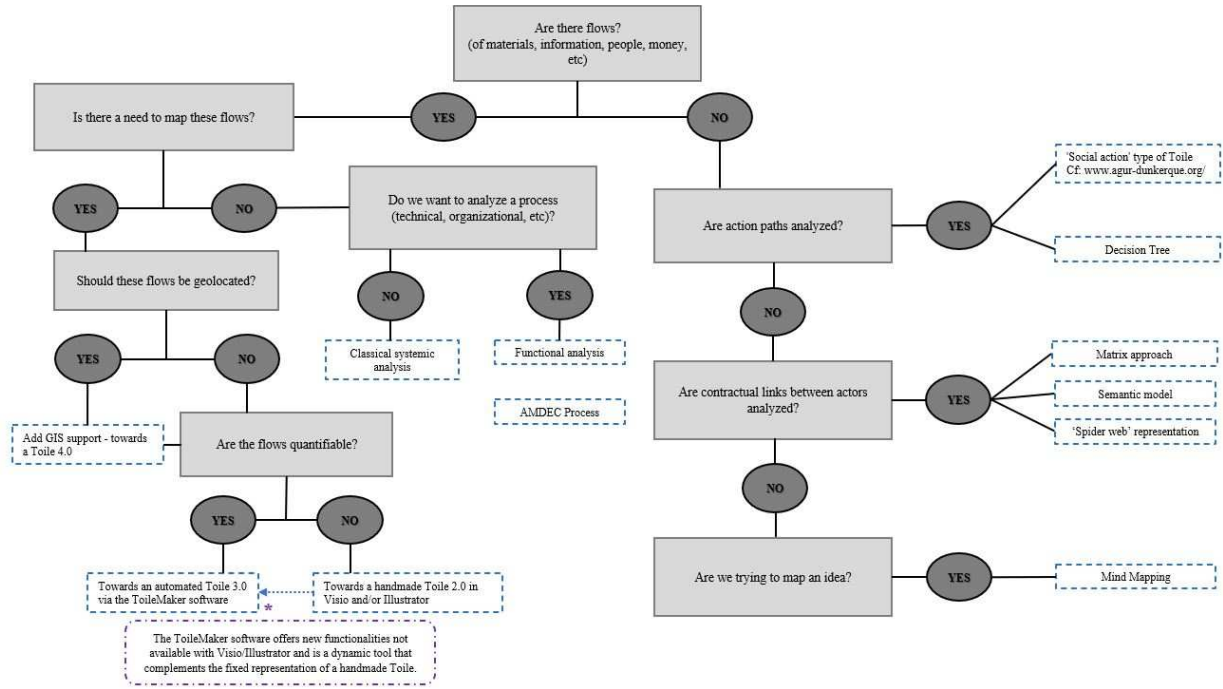


Fig.1. Decision tree of territorial cartography

IV. FINDINGS

A. Description of the 'Toile' tool

Created by Jean-Francois Vereecke, Deputy Director General of AGUR and economist, the 'Toile' tool is inspired by Jol De Rosnay's reflections on systemics and by one of his books entitled 'Le Macroscopie, vers une vision globale' (first published in 1977). It is a systemic representation of a territory highlighting the flows and links between its entities. Initially used for industry, the concept of the Toile has now been extended to several themes: energy, water, agri-food, know-how (including training), innovation and social issues. The objective is to reveal opportunities by facilitating the understanding of the dynamics of the territory (interactions between actors, availability of resources, etc.), by enhancing symbioses between actors, by strengthening foresight tools, by promoting innovation, the new, the unusual, etc. Thus, the Toiles proposed by AGUR constitute levers of resilience that make it possible to structure and carry out broader cross-cutting approaches in the service of resilience [32].

In Figure 1, a decision tree situating the 'Toile' among other territorial mapping tools allow to visualize the added value of the tool in the field of territorial cartography tools.

Based on the different diagnoses presented and the state of the art developed earlier in this paper, we can now establish the different connections between the 'Toile' tool and the systemic resilience of a territory. Indeed, the various transformations that our territories are undergoing due to climate change, economic, social and health crises, etc., are challenging their modes of operation. It is the main responsibility of territorial bodies to rethink the organization of these territories to enable them to better react to disturbances and to integrate new dynamics favoring territorial resilience. However, based on the conclusions of the state of the art presented above, we can say that there are

few universal tools, i.e. applicable to any type of territory, which enable territorial organizations to carry out this reorientation process aimed at rethinking the whole of territorial systems in a **systemic** and **collective** manner. Indeed, in most cases, the territorial organizations apply **linear** and **punctual** methods, not adapted to the complexity of their territorial systems and then find themselves on the margin of their context. How can we facilitate the transition of territories towards a new and more resilient way of functioning when territorial organizations work in a compartmentalized and linear way and have not yet developed systemic reading and piloting logics? How can the 'Toile' tool be integrated into this dynamic?

The various testimonies gathered during the study have made it possible to gain a clearer understanding of the role of the Toiles on the resilience of a territory. It is seen above all as a communication tool that allows the actors of a territory to be (re)assembled and to think about this same territory collectively. Far from being fixed in time, the tool is also meant to be evolving and interactive. Indeed, the Toiles evolve with and make the territory evolve by highlighting the axes of development in line with its major current economic, energy and health issues, etc. This visibility of the territory offered by the Toiles in terms of anticipation and foresight strengthens and supports the steps towards territorial resilience. Thus, the Toiles become proactive models in the management of territorial resilience.

Moreover, the classic indicators, often in the form of grids or analysis tables, are mostly static indicators (in the analysis available in Table 1 we can count 23 out of 25). These indicators do not make it possible to translate the setting in motion and the dynamics relating to the territories.

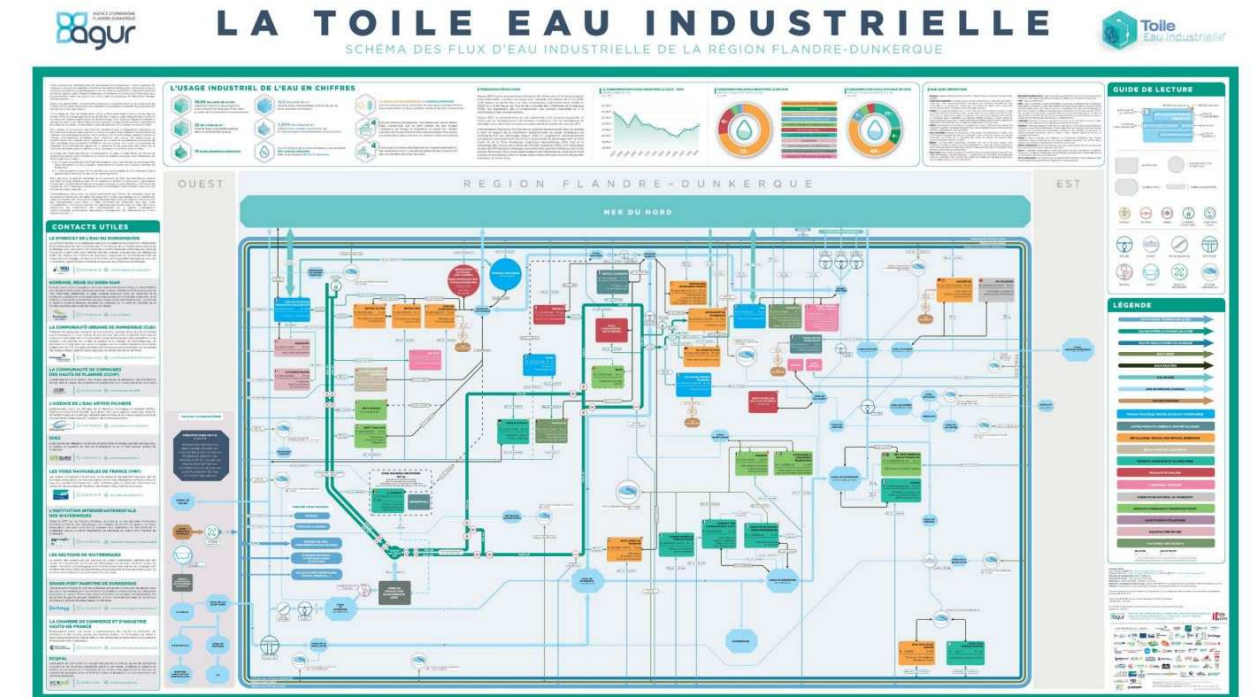


Fig.2. The Water Cycle Toile

The indicator approach alone is therefore not sufficient and requires the use of other complementary tools. This is where the systemic 'Toile' tool comes into its own, as it belongs to one of the five pillars of territorial resilience, that of 'self-organization' [7], offering a realistic vision of the complexity of a territory: its history via a Timeline, its identity, its strategies, its dynamics, its environmental, economic and political issues, etc.

As a reminder, the 'Toile' approach can be adapted to all the themes of a territory: industrial fabric, energy resources, water management, agricultural production and agri-food circuits, know-how and innovation, interrelations between social action actors, etc. This transversality of application allows the tool to be included in the dynamics of global resilience applied to an entire ecosystem.

Finally, the 'Toile' tool is part of the dynamic of decision support tools. Its visual character, making the territory accessible and analyzable, is a significant asset in the process of operationalizing resilience in terms of choices [17]. In the long term, one way forward would be to combine this systemic approach with a multi-criteria decision support approach [4], [35]. This dual approach would make the 'Toile' tool even more relevant in the context of our analysis, since it would make it possible, in addition to illustrating the territory, to model and rank scenarios that are more or less favorable to resilience, taking into account all the variables.

B. Illustrative cases of the 'Toile' tool supporting systemic resilience

In order to highlight the impacts of the Toiles on the systemic resilience of the Flanders-Dunkirk Region, here is an extract from the analysis of their uses. Each use refers to one of the standard indicators of sustainable development issued by the European organization Eurostat. This support allowed us to identify the diversity of the study themes on which the 'Toile' tool is used in its role of supporting the implementation of systemic resilience.

a) *Clean water and sanitation:* The use case of the Water Cycle Toile, Figure 2 and <https://bit.ly/3Mne6HQ>, a key issue for the Dunkirk region. It was from the 12th century onwards, when the region was still under water, that the "Wateringues" were dug, leading to the drying up of the territory. The Dunkirk area, which has few drinking and/or industrial water resources, is also subject to flooding due to the complex management of the "Wateringues". The Water Cycle Toile allows the identification of sensitive points as well as strategic opportunities for the management of water flows on the whole territory to prevent floods and supply the territory with drinking water while avoiding any risk of shortages. The Toile also facilitates the optimization of water use in the industrial sector, which is a major consumer in the Dunkirk area.

b) *Industry and innovation:* A 'Toile' allows an analysis of a sector from upstream to downstream and the identification of opportunities, points of fragility, dependencies or malfunctions in order to move towards more sustainable models.

In terms of territorial foresight and strategies, the 'Toile' tool allows the simulation of sudden changes of an economic, ecological, health or other nature. For example, it is able to illustrate the "cascading" consequences on a territory due to a shock or a change in the urban fabric.

For example, the harbour of Dunkirk has called on the Industrial Toile to position the port territory in the post-refinery sector. Indeed, since 2010, the number of refinery closures in Dunkirk has continued to increase, freeing up dozens of hectares of quayside land and threatening hundreds of jobs. The Toiles allow a preventive visualization of the chain of consequences due to the closure of industrial groups. Links can then be drawn to all the structures potentially impacted by the collapse of the group to prevent possible effects and make the best decisions in full knowledge of the facts (safeguarding jobs, reusing wasteland, etc.).

c) *Affordable and clean energy*: The application of the Toiles on the energy thematic: the establishment of a new hydrogen-producing structure in Dunkirk. It should be noted that this is an energy that is still not very widespread in the industrial sector and consequently difficult to promote. The company, wanting to set up one of its production sites in the Dunkirk area, has to identify potential outlets for its by-products and deal with the constraints linked to its high volume of water consumption. With the help of the Toiles, this company was able to visualize the territory as a whole, particularly in industrial and energy terms. This systemic understanding enabled it to identify potential synergies (or partnerships) with companies present in the industrial fabric, but also the different accesses to the territory's resources. In this way, the company is assured of finding the right location for its activities.

d) *Good health and well-being*: The 'Toile' tool helps to understand complex systems such as territories. It offers a global vision of the system and its ecosystem, while allowing a detailed knowledge of it.

In order to respond to the human, environmental or economic needs of the territory, the 'Toile' tool offers the necessary keys to the actors of the territory (elected officials, technicians, etc.) to facilitate and guide their decision-making.

For example, the AGUR has built a 'Toile' of social action actors to help social actors find their way in a complex institutional system. This 'Toile' allows for an adapted support to each citizen according to his/her life problems (e.g. young people with disabilities).

There are other examples that demonstrate the relevance of the 'Toile' tool to the systemic resilience of a territory but we will not be able to discuss them in this paper for lack of space.

V. PERSPECTIVES – OPENING TO OTHER TERRITORIES

The analysis of the 'Toile' tool highlights improvement tracks that condition its integration process in a systemic resilience perspective. In particular, both in terms of developing new themes of representation, and in terms of opening up the tool to other territories. Although the Flanders-Dunkirk Region Urban Planning Agency has already transposed its tool to numerous themes, new fields of reflection are emerging. Among them: the circular economy, waste management, etc. These new themes would strengthen the integration of the 'Toile' tool within the dynamics of systemic resilience. At the same time, the Toiles concept is gaining in power and visibility. It would seem appropriate to study and experiment with the potential for exporting the tool to other territories in order to be able to validate the hypotheses putting forward the correlation between the implementation of systemic resilience and the 'Toile' tool.

The various workshops and surveys discussed earlier in this paper have made it possible to carry out an initial study of territories not familiar with the Toiles concept. The aim of this study was to evaluate the feasibility of exporting the tool and to identify potential obstacles to a 'Toile' methodology for a French territory.

Some territorial organizations have already applied the Toiles approach and have tried to transcribe and illustrate their territory in the form of a systemic diagram. Few of them

have succeeded in making the approach permanent and in making the tool a part of everyday life. This is due to unsuitable governance, unidentified sectors, complex games and uses that are not appropriate to the needs of the territory. However, the enthusiasm of local elected representatives and technicians regarding the tool is certain; the Toile is perceived as an asset that favors the development of a territory. Future work may try to highlight elements of measurement proving the impact of the 'Toile' tool on the Dunkirk territory beyond the observations made in this paper.

We note that many methodological points diverge when implementing a territorial mapping tool like the Toile, due to the singularity of each territory. In our case, let us recall that the Flanders-Dunkirk Region has the particularity of being a highly industrialized area and at the center of international exchanges via its geographical positioning. The surveys revealed the difficulties encountered by the other territories, which have their own issues, in identifying with the Dunkirk territory. Consequently, these territories do not always see the interest and added value of the 'Toile' tool in their context.

In terms of use, the Toile presents interests for cooperation between actors in a territory. Indeed, although the facilitation of collaborative sessions does not seem to be easy in view of the multiplicity of actors present on a Toile, the tool remains a simple and objective communication support illustrating the reality of the territory. It allows information to be shared and can serve as a basis for decision-making, particularly during exchanges between elected representatives and technicians of the territory. Through interviews, we were able to make the link between this 'Toile' tool and the reflections led around the concept of Territorial Intelligence, which also aims at structuring dense and complex knowledge networks in such a way as to be able to communicate them easily. As a reminder, Territorial Intelligence translates into an 'innovative, mutualized and networked organization of all the information and knowledge useful for the development, competitiveness and attractiveness of a territory, collectively and for each of its actors' [36].

These initial survey results illustrated the feasibility of implementing the 'Toile' tool in new French territories. Nevertheless, the sustainability of the approach is questioned in view of the negative experiences of some territories. These experiences only reinforce AGUR's ambition to diffuse its know-how through the publication of a white paper explaining the success criteria of a 'Toile' project, such as the importance of upstream questioning and the need for a long-term involvement in this type of project, the choice of an appropriate governance. For the latter, we suggest the Living Lab approach built around the 'Toile' tool and led by a key player in the territory who knows its characteristics, its interplay of actors, etc. (e.g. urban planning agency). This approach enables the identification of real challenges in the territory and the co-creation of sustainable solutions with a panel of local actors [24].

It should be noted that this study remains minimal. It could be largely consolidated, by means of a questionnaire geared more towards the phenomenon of resilience and extended to the international level in order to strengthen its validity.

VI. CONCLUSION

The global changes observed on a planetary scale are generating new complex configurations at the local level that are difficult to grasp using conventional territorial management systems. To overcome these transformations, territories are reviewing their functioning and are increasingly turning to resilience modes. To do this, they are using indicators to assess the feasibility of territorial resilience. However, these indicators are far from certain and have their limits, their objectivity and relevance are particularly questionable. Then we will ask ourselves what tools can be used to overcome these limitations. We will find an answer in the case study of the 'Toile' tool developed by the Flanders-Dunkirk Region Urban Planning and Development Agency (AGUR) and based on the systemic representation of a territory, i.e. on a global and representative vision of the complexity of this territory. The tool offers a visibility of the territory allowing to show strategic development axes, in particular in the service of resilience. The 'Toile' tool is therefore a complementary reading tool to the indicators used to measure the feasibility of territorial resilience and offers serious food for thought for the implementation of systemic resilience in a territory. Furthermore, thoughts are being given to the creation of a ToileMaker software to further automate the process of creating and using the 'Toile' tool.

This notion of systemic resilience is still little addressed in the scientific literature, particularly outside France. However, it is increasingly part of the major current territorial issues, which reflect the growing complexity of our ecosystems. In the context of the study developed in this paper, a definition of systemic resilience is proposed, which allows this new model of resilience to be further materialized. We have seen that this emerging typology of resilience is characterized by its circular and dynamic nature, but also by its ability to make a complex living system proactive in the face of external disturbances. Moreover, in order to observe the particularities of this resilience, this paper reports on an analysis of the 'Toile' tool in the Dunkirk area, a rare illustration of the phenomenon of systemic resilience to date.

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