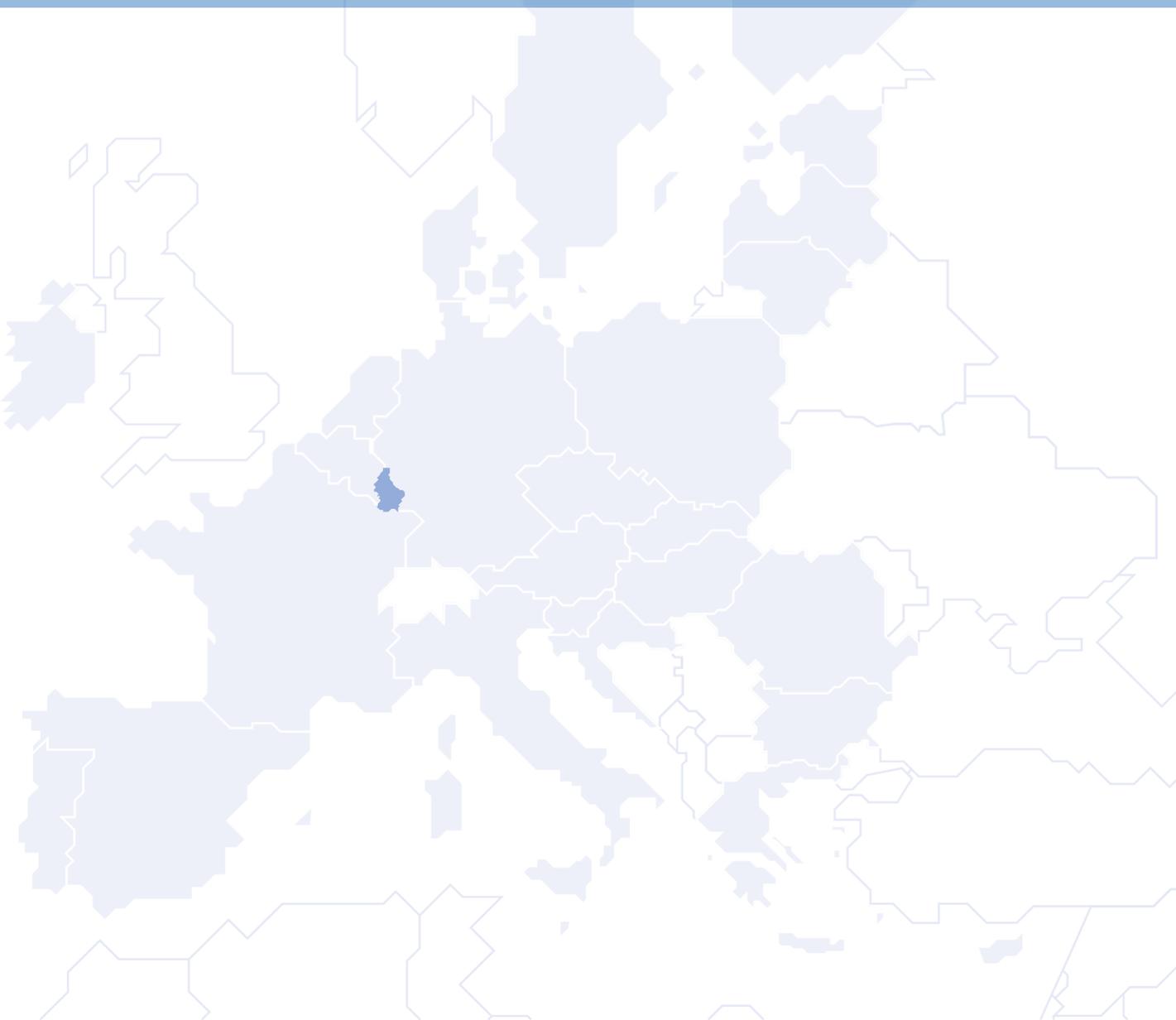


Resilience, sustainability & competitiveness

Resilience, sustainability and competitiveness

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Résumé

Résilience, durabilité & compétitivité

Le premier chapitre analyse le concept de **résilience** et est structuré comme suit :

1. La résilience, un concept populaire utilisé à de nombreuses fins
2. Définir la résilience dans le temps et selon les champs : des secteurs aux systèmes
3. Résilience et durabilité : des labels différents pour un même concept ?
4. Objectiver la résilience : les tableaux de bord de la résilience de la Commission européenne
 - a. Une description préliminaire de la méthode retenue pour les tableaux de bord de résilience de l'UE
 - b. La performance du Luxembourg à travers les tableaux de bord de résilience de l'UE
5. Qu'est-ce que cela signifie pour le Luxembourg ? Des chocs aux stocks ?

Issu de la science des matériaux et de la psychologie, l'usage du concept s'est étendu à l'écologie, la sociologie, la géographie ou encore à l'économie. Sous l'effet des récentes crises économique et financière, sanitaire liée à la COVID-19 ou climatique menaçant de plus en plus des existences et des infrastructures, il est aujourd'hui devenu tendance de renvoyer vers la résilience comme une réponse prometteuse à toute sorte de vulnérabilités et de difficultés dans la gestion des risques.

Ainsi, de nombreuses définitions de résilience ont vu le jour. La définition minimale de résilience pourrait être « la capacité de rebondir après un choc ».

Résilience et durabilité sont deux concepts distincts, entre autres dans le sens où le premier concept se réfère à un moment ponctuel lié à une perturbation, alors que le second cherche à s'inscrire dans le long terme. La résilience renverrait vers l'acuité, la durabilité vers un processus. Le débat reste aussi ouvert sur la nature et le degré de *transformation* ou *transition* (de la simple reconstruction à la rupture et au changement systémique), visés par les deux concepts. Les avis convergent pour dire que ni l'un ni l'autre n'est une solution miracle. Il est nécessaire d'avoir des attentes réalistes par rapport à ce qu'un système durable ou résilient peut fournir, en fonction du degré de risque qu'une société est prête à accepter.

Ce chapitre examine ensuite la proposition de tableaux de bord de la résilience de la Commission européenne, publiés fin juillet 2021. Sur base de la définition retenue par la Commission européenne, ces tableaux ont pour but d'apprécier la résilience des États membres de l'Union européenne, et d'identifier les points forts à améliorer ou à répliquer, ainsi que les vulnérabilités auxquelles les États membres doivent faire face.

La méthode proposée par la Commission européenne pour l'Europe est ensuite comparée à d'autres méthodes similaires, notamment celle sous-jacente aux « Objectifs de développement durable » des Nations Unies, déclinés au niveau national dans le cadre du 3^e Plan national pour un développement durable. Enfin, ces cadres supranationaux sont rapprochés du cadre national de la mesure de la compétitivité de l'économie.

Il est conclu qu'il serait utile d'adapter la mesure de la résilience au contexte national, tel que cela a été le cas pour celle du développement durable. Des premières idées sont actuellement en discussion sur comment mieux refléter la situation spécifique du Luxembourg lorsqu'il s'agit d'asseoir la résilience.

1.1 Resilience, a popular concept used for many purposes

Since 2018, Luxembourg's Ministry of the Economy has been exploring the issue of "resilience" in conjunction with competitiveness. In 2018, an international conference on *Competitiveness Strategies for the Small States of the EU* organised by the Ministry's **Observatory for Competitiveness** (ODC) generated major insights on the subject matter.¹ In 2020, the notion of resilience appeared for the first time in the **Competitiveness Report** (*Bilan de la compétitivité*) prepared annually by the ODC.

The present chapter examines the concept of resilience by reviewing some of its definitions and by exploring, against the background issue of competitiveness, the links between resilience and sustainability. These are two resembling concepts, which hint at similar objectives and frameworks of evaluation: to improve or re-establish human well-being in a lasting and just manner. The chapter then discusses the way that the European Commission measures resilience and its implications for Luxembourg. The aim is to contribute to a common understanding of the concept of resilience and its measurement, to explore methodological limits, practical shortcomings and operational opportunities and to evaluate the conditions in which the notion could be adapted and applied to Luxembourg's economy. This is conducted in order to get a better sense for the economy's soundness and performance under the two complementary perspectives of competitiveness and resilience.

The term "resilience" stems from the Latin verb "*resilire*", which means "to bounce back" or "to jump back". It has gained prominence in recent years.

The notion has long existed as an academic concept. It was restricted to psychology and the material sciences before it expanded into the ecological sciences at the end of the 20th century, largely through the work of C. S. Holling.

Enduring and converging global crises, such as climate change, resource depletion and widening social inequality, have spurred interest in scientific and policy circles for systemic societal change. The ensuing calls for "transformation" and "transition" resonate a growing consensus that business-as-usual is insufficient for keeping humanity within a "safe operating space" (Hölscher 2018).

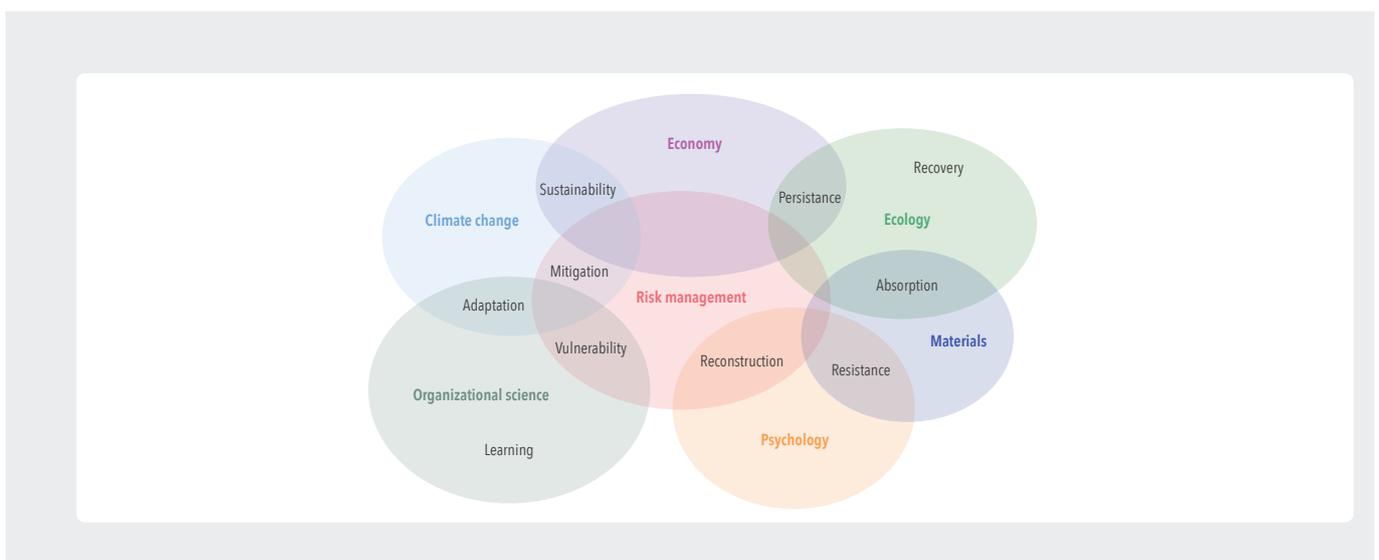
A new momentum arrived in 2020 with the global COVID-19 pandemic and the need for societies and economies to recover from its shock. Today resilience has spread outside the scientific domain to enter most sectors and managerial communities (see figure 1 below). Indeed, resilience is widely seen to be a promising response to systemic vulnerabilities and recurring difficulties in all types of risk management.

1.2 Defining resilience across time and fields: from sectors to systems

In the late 19th and in the early 20th century, resilience was commonly used in the **material sciences**. In this context, it describes the ability of a material to absorb energy (e.g. the energy that comes from a blow) and to release that energy as it springs back to its original shape (Merriam-Webster, 2021). As such, a rubber band is very resilient while a ceramic bowl is not, since it cannot regain its original shape once broken.

Figure 1

The multidisciplinary aspect of resilience



"(...) the polysemy [of the concept resilience] seems to legitimize a semantic blur that creates theoretical and operational dead ends. In view of occasional contrary injunctions, the concept ends up being 'inoperative', reduced to some sort of unattainable discursive utopia (...)." Source of the figure and the quotation: Reghezza-Zitt et al. (2012)

¹ See <https://odc.gouvernement.lu/en/actualites/mes-actualites/2018/Conference-Small-States.html>

The traumatic experiences of the First World War directed research interest towards psychological and emotional stability. In **psychology**, “resilience” is “the process of adapting well in the face of adversity, trauma, tragedy, threats, or significant sources of stress (...). As much as resilience involves ‘bouncing back’ from these difficult experiences, it can also involve profound personal growth” (American Psychological Association, 2021).

The definition designates the ability of a person to react to an unexpected event that might be deeply troubling for them. The level of resilience is however very subjective in the sense that it varies greatly from one person to another. How resilient one is depends on many factors: one’s social background (family, income, friends...) or one’s biological condition for instance. However, it is not a binary variable and rather a continuous variable that can vary over a lifetime (Southwick et al., 2014).

In **engineering**, resilience measures the ability of a system to withstand a shock and the time it takes to return to a steady state. It describes the ability of a system to continuously perform, even when put under pressure by different kind of shocks. In particular, this can be reached through the so-called “fail-safe design”. The aim of that design is to minimize the losses and damages following an external shock and to optimize the time it takes for the system to return to its full capacity (Holling, 1996).

Ecologists have adopted a similar definition that focuses on stability near an equilibrium state, on the ability to absorb a shock while maintaining existing functionalities and on the speed at which the system recovers from the shock and returns to its steady state (Ibid.).

The hunter-prey relationship may be a good example to illustrate the early uses of the concept of resilience in or for ecology. It is assumed that the prey animal population oscillates around a certain equilibrium number of animals. If an external shock arises and the number of predators increases in the territory where the prey lives, then the population initially drops due to a more intense hunting and killing activity. However, nature tends to self-regulate and as predators run out of prey their population also shrinks. Eventually, the prey animal population will start increasing again: as predators starve to death, their number decreases and preys get more room to flourish.

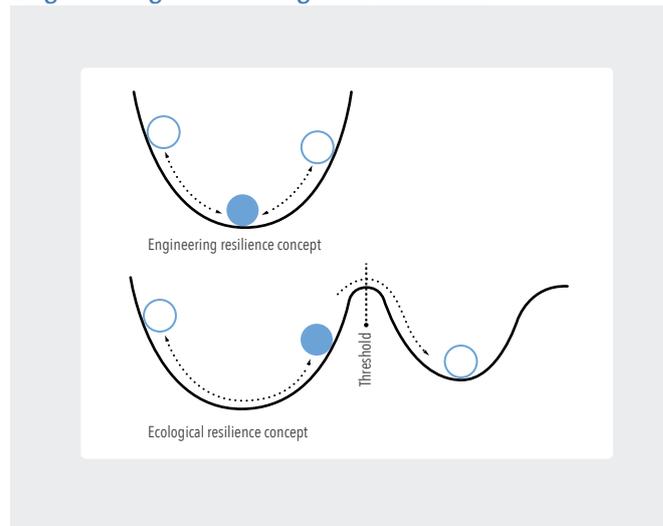
Crawford S. Holling, a Canadian ecologist, criticized the static conception by which resilience is a system that oscillates around a static equilibrium in an ecological environment. He argued that this view insufficiently takes into account the possibility of a changing environment. The conditions under which an ecological system exists do change. He observed that severe instabilities could put a system on a radically different track by altering behavioural patterns and by remoulding relationships among the variables of that system.

Holling distinguished between **engineering resilience**, pointing at the efficiency of a system, and **ecological resilience** designating the overall existence of the system (Ibid.). Hence, the system could converge to a completely new equilibrium after a shock, once a certain tipping point is reached. Resilience is then a measure of the magnitude of effects that are tolerable before the

system flips. Holling argued that “resilience determines the persistence of relationships within a system and is a measure of the ability of the system to absorb changes of state variables, driving variables, and parameters, and still persist” (Holling, 1973). Figure 2 below illustrates the different facets of resilience by contrasting engineering resilience and ecological resilience and by showing, under ecological resilience, how the equilibrium of a system can change once a certain tipping point is crossed.

Figure 2

Engineering and ecological resilience



Source: Liao (2012)

Sociologists have also been concerned with resilience in their investigations of human societies. Societies are systems of social interactions. Resilience, in a **sociological context**, then looks at the ability of a society to react to external shocks and adapt to new settings. The main difference between natural and social systems is that the latter can proactively adapt to changing circumstances by anticipating external shocks. While ecosystems cannot deliberately prepare for shocks, a society can actively take measures to mitigate the possible adverse consequences of unexpected events (Harendt & Heinemann, 2018).

Here is how the United Nations’ Office for Disaster Risk Reduction (UNDRR) defines resilience in its discussion of societal **risk management**. Resilience is “the ability of a system, community or society exposed to **hazards** to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its **essential** basic structures and functions” (UNDRR, 2015, emphasis added). The focus is on the restoration and continuity of vital functions. For the UNDRR, practising resilience means anticipating, planning and acting.

In the field of **geography**, “resilience” refers to the ability of a system (social, spatial, economical, etc.) to reproduce itself: it is not a continuity without change but the ability of an element to maintain itself through a disruption or even to assimilate the disruption into its regular functioning (Reghezza-Zitt et al., 2012).

When looking at society and its parts, it is interesting to notice how the concept of resilience is applied to the **economy**.²

The World Bank, for instance, distinguishes between **macro- and microeconomic resilience** (Hallegatte, 2014). **Macroeconomic** resilience is the ability of an economy to minimize aggregate consumption losses. It combines instantaneous resilience, which is the capacity of an economy to limit the magnitude of immediate production losses for a given amount of asset losses, and dynamic resilience, which describes the economy's ability to reconstruct and recover from aggregate asset losses. **Microeconomic** resilience is more concerned with the distribution of the aggregate losses. One may for instance observe that, in the event of a shock, high-income households are more resilient than low-income and vulnerable ones. This comes with the assumptions that shocks can be overcome with money. However, in the case of a large-scale climate-related disaster resulting in food, electricity or water supply failures, monetary assets alone can do little to procure one with resilience.

Briguglio (2016) takes a closer look at the **economic vulnerability of small States** and concludes that the main factors, which make small open economies particularly exposed to external shocks, relate to:

- Trade openness;
- Export concentration;
- Dependence on strategic imports (food or fuel), which are very price and income inelastic;
- Proneness to disasters, which lead to economic shocks and exacerbate the effects of external shocks.

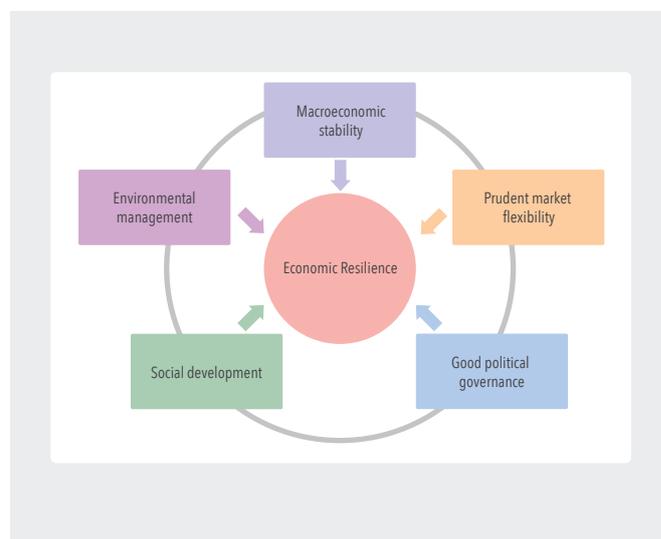
Consequently, Briguglio proposes the following policy measures to stimulate economic resilience:

- Macroeconomic stability which allows policy manoeuvre following an external shock;
- Prudent market flexibility enabling the economy to adjust following external shocks;
- Good political governance;
- Social development and cohesion, which enable the economy to function without the hindrance of civil unrest; and
- Environmental management, which generates stability through enforceable rules, economic instruments and moral suasion.

Based on this work, the author suggests an **economic resilience index**, illustrated in figure 3 below.

Figure 3

Components of an economic resilience index



Source: Briguglio (2018)

Harendt and Heinemann (2018), in their definition of economic resilience, insist on the ability of an economy to take **anticipative and precautionary measures** in order to deal with a crisis, to mitigate its immediate effects and to adapt to the new economic environment.

For Hybrid CoE, the European Centre of Excellence for countering hybrid threats,³ it is key to regard the resilience of systems that are **vital for the livelihoods of populations** and the functioning of societal systems. In that context, they define economic resilience as “a broad systemic-level concept, which consists of the security of supply of critical services, products and raw materials, market-access security, access to finance and trade routes, overall socio-economic security and critical infrastructure⁴ protection”. Hybrid CoE usefully points at the more obvious vulnerabilities of open-market economic systems:

- The “just-in-time” delivery imperative, where stocks of all kinds of goods are reduced on purpose in order to avoid costs. In the event of a major disruption of market-guided logistical systems, reserves near the end user would be scarce;
- Globalisation, the lack of control over problems that arise abroad and the long delivery distances for many goods, acknowledging that few countries are self-sustaining in basic goods;
- The dependence on digitalised logistical systems, which are prone to failure;

2 The EU Joint Research Centre (JRC) has attempted to identify different country characteristics that might be associated with resilient behaviour in reaction to the economic and financial crisis that started in 2007. See also Lino Briguglio and Melchior Vella, from the University of Malta, and their presentation during the conference on *Competitiveness Strategies for the EU Small States, Observatory for Competitiveness*, Luxembourg, 19-20 April 2018, <https://odc.gouvernement.lu/dam-assets/actualite/C3%A9s/events/2018/conference-small-states/session-4-4-briguglio-vella.pdf>

3 <https://www.hybridcoe.fi/coi-vulnerabilities-and-resilience/>

4 Hybrid CoE classifies critical infrastructures as follows: energy production, nuclear power, water supply, food supply, waste management, critical health infrastructures, transmission and distribution systems, transport and logistics networks and services, data communication systems, networks and services of the digital society, payment and securities trading systems, space systems. www.hybridcoe.fi

- A general market dependence, where the public sector has no direct command or control over critical infrastructures or basic goods companies in normal situations. Nevertheless, the State can regulate or publicly fund measures of preparedness;
- Systemic and/or market disruptions that may very quickly lead to severe political consequences.

The need for a certain continuity during emergencies is also amplified in the context of climate change. **Climate resilience** “includes on the one hand the capacity to deal with a climate shock, to recover from a shock and return to pre-shock performance while limiting losses and damages from the shock. On the other hand, it also includes the ability to continue operating while witnessing gradual changes of climate conditions” (Jancovici et al., 2021).

In preparation of the 2021 G7 summit in Cornwall, which took place under the British presidency, the OECD highlighted three necessary qualities for achieving economic resilience (2021):

- Preventing the build-up of potential vulnerabilities;
- Preparing to absorb shocks when they occur; and
- Developing the ability to engineer a swift rebound from those shocks.

This raises the issue of knowing to what extent and under what circumstances economic resilience is deemed compatible with resource efficiency, sovereignty and scarcity. The Circularity Gap Reports challenge the assumption that economies are on track to achieve resources efficiency: in 2021, the world economy was only 8.6% circular. It extracted and consumed some 100 billion tonnes (Gt) of materials in a linear manner.⁵ In Luxembourg, improving resource efficiency is also made difficult by the expansion of the population and its consumption aspirations (Junker, 2020). In an overall race towards producing more with less, increasing efficiency also often means minimizing redundancy and stock. This, in turn, can lead to a greater vulnerability as there will be no fall-back systems or spare capacities in the event of a shock. Overcapacities that can serve as a buffer are essential when a shock occurs. They can act as a safety net. A topical example here are spare hospital beds that have been used to accommodate patients in need during the COVID-19 pandemic.

Following Brinkmann and colleagues (2017), one may conclude that the concept of resilience can become a normative economic policy principle. That may be if resilience is not viewed too narrowly as a static concept, if it is applied to critical functions and to their continuity, if it is linked to the societal objectives within a given economy and if the interplay of different societal levels and environmental aspects is taken into account.

Humanity has now entered an era where it has a decisive impact on the Earth’s climate and its ecological systems. Many scientists believe that for the first time in history, instead of the planet shaping humans, humans are knowingly shaping the planet. This is the Anthropocene – the Age of Humans – a new geologic epoch (UNDP 2020).

Scholars from the Stockholm Resilience Centre (SRC), and in particular Professor Folke, were among the first ones to work on a discipline-overarching definition of resilience that perceives humanity as an integral part of a socio-ecological system. In 2015, the SRC defined resilience as “the capacity of a system, be it an individual, a forest, a city or an economy, to deal with change and continue to develop. It is about the capacity to use shocks and disturbances, like a financial crisis or climate change, to spur renewal and innovative thinking” (SRC, 2015).

The definition was expanded in 2016 in a discussion of **socio-ecological resilience** that put additional emphasis on transformation: “Social-ecological resilience is the capacity to adapt or **transform** in the face of change in social-ecological systems, particularly unexpected change, in ways that continue to support human well-being (...). Adaptability refers to human actions that sustain, innovate, and improve development on current pathways, while transformability is about shifting development into new pathways and even creating novel ones” (Folke et al. 2016, emphasis added).

One may now consider further generic definitions that have recently been added.

The OECD defines “resilience” as “the ability of individuals, communities and States and their institutions to absorb and recover from shocks, whilst positively adapting and transforming their structures and means for living, in the face of long-term changes and uncertainty” (2013). Here, the definition brings added focus on the sense that one can actively take action in order to improve resilience.

In its *Strategic Foresight Report 2020*, the European Commission uses a similar definition: “Resilience refers to the ability not only to withstand and cope with challenges but also to transform in a sustainable, fair, and democratic manner” (2020a). It added in another report that every European citizen should be able to live in good health and prosperity and that no one should be left behind during the transitions lying ahead (2020b).

One of the most exhaustive definitions currently in circulation is one by CEREMA, a French think tank that specialises on risk, mobility and environmental issues:

“[Resilience is] the capacity to anticipate changes, abrupt or slow, through continuous surveillance and prospective thinking, to minimize the effects, to recover and grow thanks to learning processes, adaptation strategies and innovation, to dynamically converge to a new equilibrium while keeping the level of functionality which existed before the shock. This state of resilience should be achieved through democratic processes. It aims to preserve the well-being,

⁵ See <https://www.circularity-gap.world/2021>

social cohesion and basic supply (food safety, water supply, energy safety...)" (Villar & David, 2014)

The scope of systems or sectors covered (from parts to whole-of-society), the time horizons (from shorter to longer terms), the types of disturbances (partial or radical) or the nature and depth of the responses (from adaptation to transformation) change across definitions. There are also great variations in the understanding of what it means to return to "normality", of what degree of discontinuity a "transformation" or a "transition" implies or of what makes a crisis a crisis.

Different kinds of shocks need to be distinguished (Comfort et al., 2010; Le Blanc & Zwarterook, 2013). There are those that can occur rather regularly and that do not pose any existential threat to the entirety of the system. These may be labelled "routine emergencies". And there are shocks that represent a serious threat to the integrity of a system but that are not very likely to occur. These are low-chance-high-impact types of events. Resilience would mostly relate to sudden shocks, such as a flood, and relatively rarely address slow and gradual changes, such as global warming (Harendt & Heinemann, 2018).

As a result of borrowings and transfers between disciplines, resilience became a **holistic and interdisciplinary** concept with multiple uses, consisting of numerous elements and depending on many variables. There is no consensus among research communities or practitioners on what resilience means. It varies considerably depending on the authors and the objects to which it is applied. To some, resilience is a property, to others it is a process or an outcome. This raises the question of whether the overall resilience of a system (a country, a sector, a community...), on a large scale and over a long period can be achieved. Or is it that resilience can only be achieved for parts of a system (be it infrastructures, food system or health facilities), on a limited scale and for a short while? Can subsystems or peripheral parts of systems adapt and transform while the core remains invariant?

Despite the fact that there is a wide variety of approaches, some common features may be distinguished:⁶ first, there is the **absorptive capacity** of a system. This means that a system or a society can react to a shock by resisting to it up to a certain degree. Second, the **adaptive capacity** measures the ability of a society or a system to implement small, incremental changes to itself in order to deal with the shock. It appears that comparatively healthier and stronger societies or systems have higher absorptive and adaptive capacities. Third, there is the **transformative capacity**. Some events can be particularly significant and have profound consequences so that small, incremental changes will likely be insufficient. This means that the society or the system will require a reset and necessitate a transformation into a new state of being (Manca et al., 2017). Reghezza-Zitt and colleagues observe that "in a very schematic way, after an impact, three states can be observed: a definitive disappearance, the survival of the system as it was, and a radical structural change of the system"

(2012). Steffen and colleagues (2015) have set minds in a particular direction of transformation by discussing the concept of "planetary boundaries". It defines and quantifies the global biophysical limits within which humanity can strive, safely and sustainably, while maintaining a stable planet Earth. If one also considers here a set of social boundaries (Raworth, 2012), then one gets the picture of a desirable societal transformation that would allow humanity to prosper within a "safe and just operating space".

A rigorous definition and a consistent use of the terminology are indispensable for the concept to be applied in such a way that it could benefit economic decision-making.

1.3 Resilience and sustainability: different labels for the same concept?

In talks about the future of society and the economy, "resilience" and "sustainability" are often confused or used as synonyms. However, the terms point at distinct, although related concepts. Contrary to resilience, sustainability is not directly related to the idea of a shock that occurs at one moment in time.

Brundtland's 1987 definition of sustainable development,⁷ sought to reconcile economic development with the protection of social and environmental aspects. Yet, it seems to have been both too vague for a common understanding to emerge and too general for a practical and local application to be effectively carried. The ultimate aim of sustainability is to ensure that every human can live in prosperity and safety without depleting the natural resources (UN Secretary General, 1987). The recent 17 UN Sustainable Development Goals (SDGs) propose 231 indicators to measure the achievement of "a better and more sustainable future for all" by 2030 (United Nations, 2017).

The SDG framework does not distinguish among economic sectors and activities and it does not include quantitative thresholds. In the absence of these elements, the 231 indicators may prove inadequate for guiding decision-makers and investors in the direction of what a "sustainable" activity is and what it is not. 35 years after having adopted the Brundtland report's definition, the EU is currently defining its own all-encompassing taxonomy in order to apply a common set of definitions and quantifiable indicators and to clearly establish what makes activities and investments sustainable. Even if resilience and sustainability point at different concepts that should not be confused, they are related. Three different categories of frameworks on how the concepts relate can be identified in the literature.⁸ In the first case, the ultimate goal of a system is to be sustainable. Resilience is then only a means for reaching sustainability. Intuitively, a system cannot be sustainable if it collapses when confronted with a shock. Hence, being resilient is a necessary condition for being sustainable. The European Commission regards resilience to be a path towards sustainability and thus falls into that category of frameworks (European Commission, 2021a). Interestingly, the Commission's work goes beyond the link

6 Additional work from the Joint Research Centre (JRC) on the concept of resilience and its definition has been made (Manca et al., 2017)

7 Sustainable development was defined in the World Commission on Environment and Development's 1987 Brundtland report "Our Common Future" as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

8 For a more in-depth analysis on that issue, see Marchese et al. (2018).

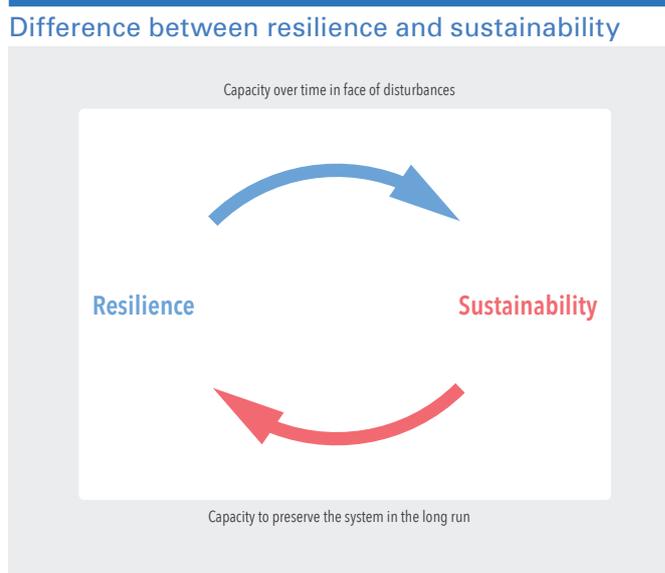
between resilience and shocks by defining resilience also in relation to **transitions and long-term structural changes**.⁹

The second kind of framework takes the opposite view, considering resilience as the ultimate end of a system with sustainability being a part of resilience. Under that view, by making a system more sustainable, one makes it less prone to shocks and thereby increases its resilience.

Finally, for the third kind of framework, resilience and sustainability are two different concepts pointing in two different directions. These may be related but not by a relation of hierarchy. Hence, a policy intervention can improve the resilience and the sustainability of a system or it can improve only one of the two aspects. It could also, for instance, improve resilience and neglect sustainability at the same time. As such, under this perception, both aspects need to be taken into consideration and to be balanced out through a case-by-case analysis.

By comparing definitions, it becomes apparent that the concept of resilience is strongly related to the reaction of a system faced with disturbances, while sustainability is rather referring to the ability of a system to carry on its operation in the long run. That includes ensuring societal well-being without depleting resources for the future generations. Figure 4 graphically illustrates the difference.

One may note at this juncture that resilience could suffer from the same limitations that have afflicted sustainability. That includes the tension between ambitious overall goals and the need for a specific and more practical definition to ensure its local application. Failure to address that might result in a heterogeneous set of applications (e.g. that of the UN SDGs, the EU SDGs or National SDGs). It might also maintain uncertainty about desired transformational pathways. Is it “back to normality” or “onwards to a new way of being”? Is it economic “expansion” or “slowdown”? On that note, Bartolini and colleague argue that promoting social capital would mean expanding well-being and enabling the economy to shift towards a more sustainable development path characterised by “slower economic growth” (2021). Another issue might relate to the formation of unrealistic expectations about the concept in the face of biophysical, temporal and territorial boundaries. Recent research (Fanning et al., 2021; Fang, 2021) indicates that historical and future trends in sustainability performance show that the world’s countries have substantially overshot their fair share of most planetary boundaries, without proportional social achievements. Disappointment may come from monitoring data issues and the partial implementation of the concept that would prevent a systemic, long-term transformation and do little in the way of bringing about a “real, true” paradigm shift.



Source: Tendall et al. (2015)

Reghezza-Zitt and colleagues (2012) suggest that no system can simultaneously be redundant, efficient, diversified, participative, flexible, robust, adaptable, local, global, etc. They go on to say that tensions, conflicts, contradictions and lack of common understanding introduce subjectivity and norm. From a methodological perspective and to avoid all sorts of abuses, it is therefore crucial to clearly set out from the start, what it is that is deemed to become resilient, who declares that resilience is attained, according to what criteria, on what scales and at which levels. This would go hand in hand with the promotion of “hazard acceptance, not as fatalism or as the acceptance of the disaster, but as the price that a society is willing to pay when this society takes a risk” (Reghezza-Zitt et al., 2012).

“It is tempting to describe apparent success in terms of resilience and apparent failure in terms of a shopping list of explanatory variables. Resilience then becomes the synonym for survival and the prescribed antidote for administrative shortcomings. This is too simple (...)

Far from a fix-it-and-forget-it approach, resilience is the outcome of a long-term process, enduring resilience is a balancing act between risk and resources, between vulnerabilities and escalating or unmanageable risk” (Comfort et al. 2010a: 272-273).

⁹ For more information see https://ec.europa.eu/info/publications/resilience-dashboards-report-and-annex_en and <https://publications.jrc.ec.europa.eu/repository/handle/JRC120489>

1.4 Objectifying resilience: the Resilience Dashboards of the European Commission

There are ways to measure resilience and several initiatives have been put in place to do that.¹⁰ For the purpose and scope of this year's Competitiveness and Resilience Report, the following section concentrates on the resilience dashboards prepared by the European Commission, accessed in the draft version of July 2021.¹¹ The dashboards are the result of an extensive consultation process with representatives of the Commission services, the Member States, the civil society and other relevant stakeholders.¹² The EU resilience dashboards monitor performance on a wide range of indicators that are used to apprehend resilience. Their main purpose is "not to rank countries but to highlight strengths to be nurtured and areas for improvement, in view of further country-specific analysis and policy action" (European Commission 2021a). To avoid duplications and highlight synergies, the Commission also sought to compare its approach with other existing multidimensional (e.g. with the SDG indicators or the Transition Performance Index) and thematic indicator frameworks (e.g. with the Circular Economy Scoreboard, the Digital Economy and Society Index, the Social Scoreboard, the Environmental Action Programme, etc.) (Ibid.). The EU resilience dashboards are aligned with the **EU definition of resilience**. According to that definition, resilience is "the ability not only to withstand and cope with challenges but also to transform in a sustainable, fair and democratic manner" (European Commission, 2020b).

The global COVID-19 pandemic laid bare how vulnerable and fragile fundamental freedoms and vital systems, such as industrial production or basic healthcare services, are. This situation, combined with other looming systemic perturbations (e.g. the climate and biodiversity crises), has generated a public demand to stress test these systems for their resilience in the face of multiple crises. As a response, the European Commission has decided to integrate **strategic foresight** into the EU policy-making.

In 2020, a first *Strategic Foresight Report* was published and promoted a more forward-looking perspective into European policy-making centred on the concept of resilience (European Commission, 2020). In its report, the Commission describes foresight as the "discipline of exploring, anticipating and shaping the future". Strategic foresight aims to explore plausible future scenarios and problems. Identifying major trends might then help to pre-emptively develop some understanding of and responses to arising problems.

1.4.1 A preliminary description of the method behind the EU resilience dashboards and its four dimensions

Figure 5 on the next page illustrates the four thematic group areas that were identified in order to evaluate and monitor the resilience of Member States: the "social and economic", the "geopolitical", the "green" and the "digital" dimensions.

The social and economic dimension designates the capacity of an economy to deal with a shock and to manage the required adjustments in a fair and inclusive way. The geopolitical dimension refers to Europe's strengthening of its "strategic autonomy and global leadership". The "green" part of resilience is "about reaching climate neutrality by 2050, while mitigating and adapting to climate change, reducing pollution and restoring the capacity of ecological systems to sustain our ability to live well within planetary boundaries." Finally, "digital resilience is about ensuring that the fundamental rights and values such as dignity, freedom, equality, security and democracy are preserved and enhanced in this digital age".

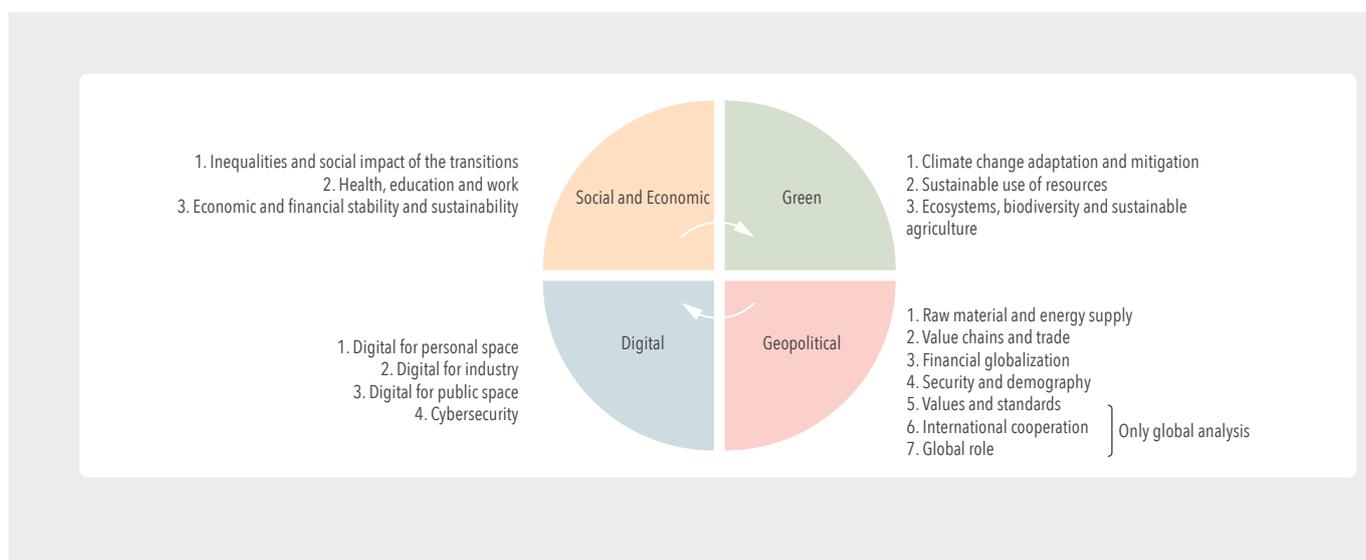
For each dimension, a dashboard of around 30 indicators is proposed to quantify and monitor the different aspects of resilience, which sums up to a total of **124 indicators** for the four dimensions. The computation of the indicators draws on publicly accessible data sources (from Eurostat, the OECD or the World Bank) in the most recent available years (usually 2018-2020). The large number of indicators is a sign of the underlying aspiration to represent the holistic and complex nature of resilience. It allows to cover the many different facets that could potentially influence economic and societal resilience.

¹⁰ The OECD for example has developed a COVID-19 recovery dashboard, in which resilience, along with three other dimensions ("strong", "inclusive", "green"), is monitored through five indicators that relate to vaccination, capital formation, internet access, trust in government and debt.

¹¹ The resilience dashboards presented here are based on the draft versions, dated 26 July 2021, of the Commission's dashboards that were available at the time of editing the current Competitiveness and Resilience Report 2021. Hence, the resilience dashboards as they are presented here might be subject to further changes. A final version has been published on the 29th November 2021. See European Commission (2021b).

¹² This participatory approach makes sure that expert knowledge is used. It is complemented with the use of objective data. The goal is to get an impartial view on resilience and to reduce subjectivity. However, some degrees of subjectivity will always remain (e.g. in the choice of variables).

The four dimensions of the resilience dashboards



Source: European Commission (2021b)

Member States are compared on the basis of their **relative performance** against each indicator. The classification does not make any statement on the absolute performance of a country but on its performance relative to the 26 other Member States across time.¹³ Member States are associated with one colour out of five that reflects their relative performance. Arrows within a box indicate the trend that the country has been following over the preceding five years. If the arrow points upward, then there has been sizeable improvement over the period. A downward pointing arrow then suggests that there has been significant worsening of the situation. In addition to the national evaluations, the level of resilience of the EU27 is also assessed.

Figure 6 gives a snapshot of the dashboard for social and economic issues with all its indices and arrows. It shows how the dashboard assesses the relative performance of individual Member States and of the EU27 (by calculating an average).

To further stress the holistic ambition, the EU resilience dashboards also classify indicators in two categories: those relating to a **“capacity”** and those relating to a **“vulnerability”**.

A capacity is “a country’s structural feature that points to elements of its system (economic, social, and environmental) underpinning its ability to cope with shocks/structural changes and achieve transitions successfully” (European Commission, 2021b). Such a capacity could for example be human capital, which includes a well-educated workforce, but it could also be infrastructural capacities fostering for instance high waste recycling.

A vulnerability, on the other hand, is “a country’s structural feature that points to elements of its systems (economic, social, and environmental) that can be disproportionately hit in case of shocks/structural changes, or can hinder the transitions (e.g., an obstacle to the transition)” (Ibid.). Such vulnerabilities include the number of employees who risk losing their jobs due to the shift to less carbon intensive production processes or due to raw material shortages. That is a vulnerability in the sense that a shock (here a sudden breakdown of conventional processes) might make many people redundant, if the shift was not anticipated and prepared through, say, reskilling.

¹³ The relevant timeframe spans from 2007 to 2017.

Social and economic dashboard of EU Member States

		BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	EU27
At risk of poverty or social exclusion rate (AROPE)	V	•	↗	•	•	•	•	↗	↗	•	•	↗	↗	↗	↗	↗	•	↗	↗	•	•	↗	↗	↗	↗	•	•	•	↗
Income quintile share ratio S80/S20	V	•	↘	•	•	•	↗	↗	↗	↗	•	↗	•	↗	•	•	↘	•	•	•	•	↗	↗	↗	•	•	•	•	•
Employment in energy intensive sectors	V	↗	•	•	•	•	•	•	•	•	•	•	•	•	•	•	↗	↘	•	•	•	•	•	•	↘	↘	•	•	•
Employment in manufacturing with high automation risk	V	↗	↘	•	•	•	↘	↗	↘	•	↗	•	•	↘	•	•	↗	•	↗	•	•	•	•	↘	↗	↘	•	↗	•
Regional dispersion in household income	V	•	↘	↘	•	•	•	↘	•	•	•	•	↘	•	•	•	•	•	•	•	•	•	•	↘	•	↗	•	•	•
Impact of social transfers (other than pensions) on poverty reduction	C	•	•	•	•	•	↗	•	↗	↘	•	↘	•	•	•	•	↘	•	↘	↘	•	↗	•	•	•	•	•	•	•
Household net saving rate	C	•	•	•	↗	↗	↗	↗	•	•	•	↗	↗	↗	↗	↗	•	•	•	•	•	•	↗	•	↗	↗	↗	↗	↗
Government social expenditures on education, health, social protection and long term care, as % of GDP	C	↘	•	•	↘	•	↗	↘	•	•	•	•	•	•	↗	•	•	↘	•	↘	•	•	↘	↗	↘	•	↘	•	•
Active citizenship	C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Antimicrobial resistance	V	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Self-reported unmet need for medical care	V	•	↗	•	•	•	•	↗	↗	•	↗	↗	↗	↗	↗	•	•	↗	↗	•	•	↗	↗	↗	•	•	•	↗	↗
Years of life lost due to PM2.5	V	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
*Variation in performance explained by students' socio-economic status	V	•	•	↘	↗	↘	↘	•	↗	↗	↘	↗	↗	•	↗	•	↘	↗	•	↘	•	↘	•	↘	•	•	↘	↘	•
Macroeconomic skills mismatch rate	V	•	↗	↗	•	•	•	↗	•	↗	•	•	•	↗	↗	↗	•	↗	↗	↗	•	↗	•	↗	•	↗	↗	•	↗
Gender employment gap	V	•	↘	↗	•	↗	•	•	•	•	•	•	•	↘	•	•	↗	↘	↗	↗	•	•	•	↘	↗	↗	•	•	•
Young people neither in employment nor in education and training	V	↗	↗	↗	↘	•	↗	↗	↗	↗	•	↗	↗	↗	↗	•	•	↗	↗	•	•	↗	↗	↗	↗	↗	•	•	↗
Long-term unemployment rate	V	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	•	↗	↗	↗	↗	•	↗	↗	↗	↗	↗	•	•	↗
Standardised preventable and treatable mortality (low rate)	C	•	•	•	•	•	↗	•	•	•	•	•	•	•	↗	↗	•	•	•	•	•	•	•	•	•	•	•	•	•
Healthy life years in absolute value at birth	C	↘	↗	•	•	↗	•	↗	•	↗	•	↘	↗	↘	•	•	•	↗	•	•	↘	•	•	•	•	•	•	•	↗
Children aged less than 3 years in formal childcare	C	↗	•	•	•	•	↗	↗	↗	↗	•	•	•	↗	•	↗	↗	•	↗	•	•	•	↗	•	↗	•	↗	•	↗
Average scores in the PISA test, reading, mathematics and science	C	↘	↘	•	•	↘	•	↘	↘	•	•	•	•	•	•	•	↘	•	•	•	•	•	•	•	•	•	•	•	•
Adult participation in learning during the last 12 months	C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Employment rate	C	↗	↗	↗	↗	↗	↗	↗	↗	↗	•	↗	↗	↗	↗	•	↗	↗	↗	↗	•	↗	↗	↗	↗	↗	•	•	↗
Active labour market policies per person wanting to work	C	•	•	↗	↗	•	↗	•	•	•	•	↗	•	•	•	•	↗	↗	•	•	•	•	•	•	•	•	•	•	•
Government debt	V	•	•	•	•	•	•	↗	↘	↘	↘	•	↘	↘	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
*Projected old-age dependency ratio	V	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Degree of specialization of the economy	V	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Non-financial corporations funding structure	V	↘	•	•	↗	•	•	↗	↗	↗	↗	↗	↗	•	↗	↗	↘	↗	•	↗	↗	•	↗	•	↗	•	↗	↗	↗
Automatic stabilisation of the tax-benefit system	C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Banking sector total capital ratio	C	↗	↗	↗	↗	•	↗	↗	↗	↗	↗	↗	↗	↗	↗	•	•	•	•	•	•	•	•	•	•	•	•	•	•
*Insurance sector solvency capital ratio	C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
*Share of innovative enterprises	C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Intangible investment	C	•	↗	•	•	•	•	↗	•	•	↗	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Government investment to GDP ratio	C	•	↘	•	•	↗	↘	•	↘	•	•	↗	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Resilience

- Highest capacities/Lowest vulnerabilities
- Medium-high capacities/Medium-low vulnerabilities
- Medium capacities/vulnerabilities
- Medium-low capacities/Medium-high vulnerabilities
- Lowest capacities/Highest vulnerabilities
- Not available

Change with respect to 2015

- Not sizable
- ↗ Sizable improvement (up) or worsening (down)

Vulnerabilities

- V Vulnerabilities

Capacities

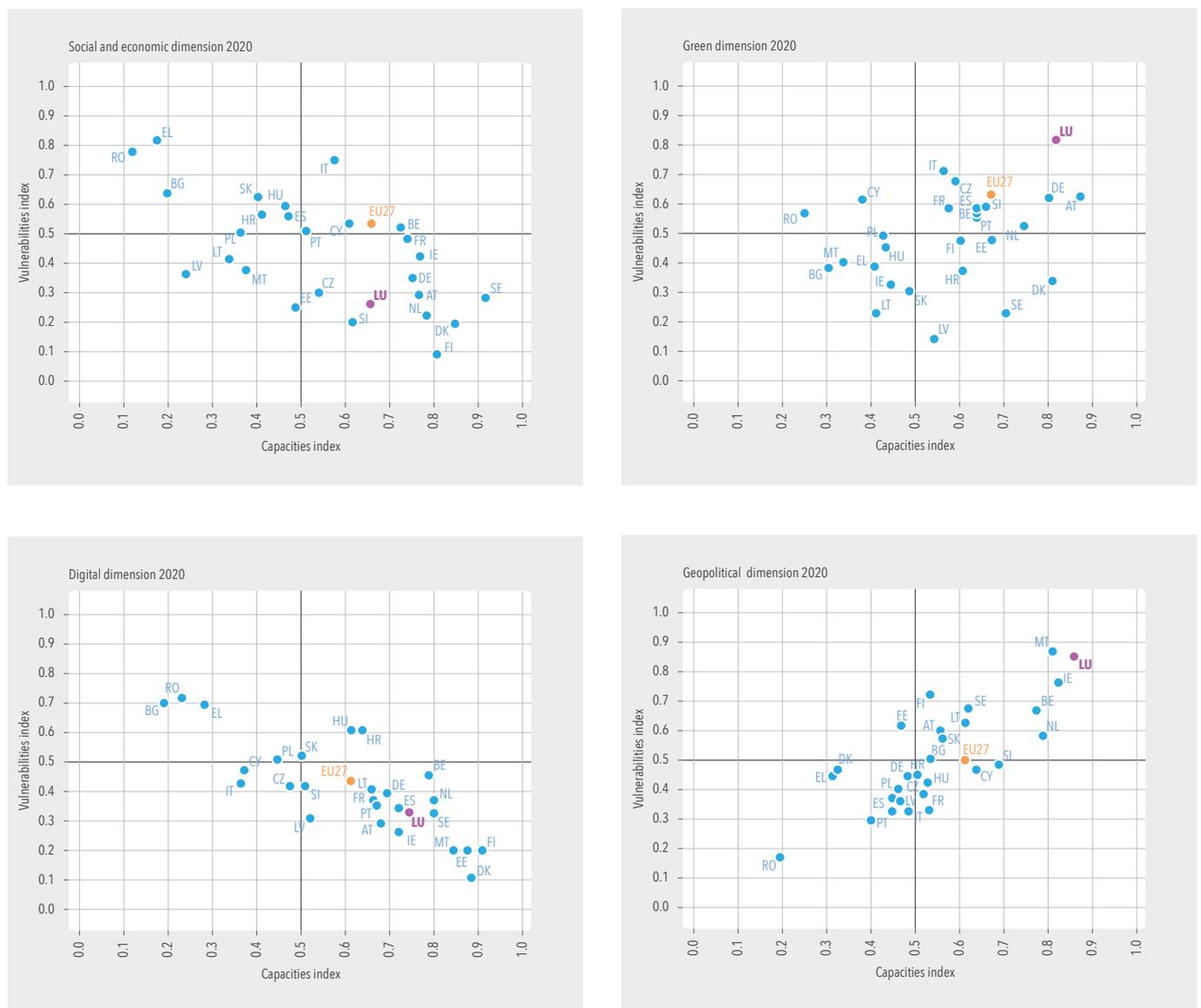
- C Capacities

Source: European Commission (2021b)

The dashboard is accompanied by two **synthetic indices**. One is for resilience capacities and the other for resilience vulnerabilities. The indices are aggregates of the relative positions of Member States across all indicators within one of the four dimensions. They enable to compare the countries among themselves on the basis of their relative resilience. The higher the capacity (or vulnerability) index, the higher the relative capacity (or vulnerability). The synthetic indices of capacities and vulnerabilities of Member States and the composite index of the EU27 are illustrated for each of the four dimensions by figure 7 on the previous page. The figure reflects the most up-to-date pieces of information at the point of publication.

Figure 7

Vulnerabilities and Capacities: Synthetic indices of EU Member States



Source: European Commission (2021b)

For the EU as a whole and by comparison to third countries, the dashboards show a mitigated picture in matters of resilience capacities and vulnerabilities: for the socio-economic and digital dashboards, the EU27 median resilience suggests a medium-high capacity and a medium vulnerability. For the green dashboard, the EU27 median resilience indicates a medium-high capacity and a medium-low vulnerability. The geopolitical dimension seems related to the lowest of all resilience capacities and to a medium vulnerability throughout the EU. Although the dashboards are not intended to rank countries, the results can be taken to detect best practices and to highlight potential areas of improvement. Under this angle, the Nordic countries (SE, DK and FI) stand out as a group of countries with low vulnerabilities and high capacities across three dimensions of socio-economic, green and digital issues. Luxembourg distinguishes itself as the country with one of the highest capacities and the highest vulnerability among its peers for the green dimension.

The dashboards seek to strike a balance between the numbers of areas covered and the number of indicators used to describe them, given the availability of quality and historical data for all Member States. This partly explains why, for instance, there are no indicators to measure food security apart from indirect agriculture indicators (i.e. farm income variability, soil carbon content, organic farming). The same can be said for behavioural aspects (and personal resilience in the event of disaster) or governance aspects relating to resilience (i.e. political system and institutions, leadership, gender equality, traditional knowledge,¹⁴ collective empowerment...).

To assess the methodological limitations of the approach, the Commission dedicated a detailed section on the gap analysis, where it discusses missing indicators, dimension by dimension. These concern aspects such as equal opportunities, efficiency of governance, food safety, green renovation, frugality, sustainable farming and forest management, responsible consumption, e-health, open data, digital democracy and dependency, cybersecurity, manufacturing capacity or demographic change (European Commission, 2021a).

Depending on the underlying assumptions, indicators may seem equivocal or not. And some are clearly related to political choices. Consider a few examples: hydrogen passenger fleets are mainly seen to have a positive influence on resilience. That point tends to neglect the on-going research debate on the overall opportunity costs of hydrogen supply for transport. While trains and buses seem to be supportive of resilience, cycling or walking are missing. The digital transition is presented as being essential for resilience. Little heed is paid to the benefits that low-tech, low-energy, manual, technical, repair competences could have for many to get back on their feet after a shock. Mathevet and colleagues (2014) point out that technological developments that depend on electricity and on communication networks leave few adaptation options when a blackout occurs or a disaster strikes.

For the Commission, it is fundamental to read the indicators together in order to form a bigger picture. In the case of hydrogen and active mobility, this would mean combining the two indicators

with the “use of public transport” indicator. To complement the picture, Member States are also invited to contextualise dashboard results with information they have locally on aspects covered in the EU gap analysis. The purpose of the resilience dashboards is to trigger an internal discussion on the strengths and weaknesses a country has in this or that area. The dashboards provide a general indication, which could be made more specific by the countries’ experts.

1.4.2 Luxembourg’s performance by the standard of the EU resilience dashboards

Before proceeding to assess the performance of Luxembourg, it is important to remember that Member States are compared with each other. A “good” or “poor” performance in the dashboards does not mean that a country is doing particularly well or badly in absolute terms.¹⁵

At this point, one can notice that for the social and economic aspects, Luxembourg compares favourably with most of the other EU Member States.¹⁶ Luxembourg is among the top performers in nine out of the 34 indicators in total and among the better performers in 10 cases. It performs particularly well in the “Projected old age dependency ratio”, which means that the ratio between the number of people aged 65 and over (people of that age are generally retired and do not work anymore) and the number of persons aged between 15 and 64, is relatively low. Moreover, a relatively large part of all the very young children in the country (60%) is in formal childcare. On the flipside, Luxembourg is one of the worst performing Member States in three cases. It is one of the lower performing countries in two cases. One issue is that the performance of students depends relatively strongly on their socio-economic background. Luxembourg also scores low on average PISA results. Another issue is the high degree of specialisation and lack of economic diversification of Luxembourg’s economy in comparison to the other Member States. These characteristics are considered to be unfavourable signs of resilience. On the socio-economic side of things, Luxembourg shows medium-high capacities and medium-low vulnerabilities in the face of distresses (figure 7 on the previous page).

For the “green” part, Luxembourg’s performance is more balanced. Out of 30 indicators in total, it is among the best performing Member States for nine, and among the least performing countries for five indicators. Resource and energy productivity is comparatively high and Luxembourg is one of the countries in the EU where the use of electric vehicles is the most widespread. Luxembourg also stands out for its high share of insured losses from climate extremes. On the other side, Luxembourg has a particularly high rate of greenhouse gas emissions per capita, especially in the road transport area. Luxembourg is among the most built-up countries in Europe, one of the reason for its comparably high loss of biodiversity rates. Renewable energies are marginal in the country’s energy mix. In 2019, the share of renewable energy in the final energy consumption amounted only to about 7%, which compares to an EU-wide share of almost 20%.

¹⁴ Traditional knowledge is “knowledge, innovations and practices of indigenous and local communities around the world. Developed from experience gained over the centuries and adapted to the local culture and environment, traditional knowledge is transmitted orally from generation to generation.” (CBD, 2021).

¹⁵ The rationale behind each indicator (i.e. responses to the questions of why is it relevant, positive or negative for resilience?) can be found in the European Commission report (2021a).

¹⁶ The data used in the following is the same data that was used in the computation of the resilience dashboards. The exact data sources are listed in European Commission (2021a).

Luxembourg performs quite well with respect to the digital indicators. It is among the best performers in six out of the 30 indicators and stands nine times amongst the better performing Member States. The difference in broadband access between rural and urban areas is one of the lowest out of the EU27. Luxembourg is also one of the countries where telework is the most widespread. In 2020, only 52,4% of the workforce reported to have never worked from home, while almost 80% of the employees of the EU27 report that they have never worked from home. The lack of possibilities to work from home is considered a vulnerability in the event of a lockdown due to a pandemic.

The country stands among the lowest performers for only two indicators and among the lesser performing countries on four in that category. Research and development intensity in the Information and Communication Technologies (ICT) is comparatively low in the country and cybersecurity seems to be a problematic issue for individuals as well as for companies. According to several Eurobarometer surveys, a comparatively high share of citizens, and to a lesser extent, of companies, has experienced cybersecurity incidents at least once. These developments might discourage individuals and firms to go digital. Yet, the Global Cybersecurity Index seems to suggest that, at the same time, Luxembourg is well equipped to deal with these threats.

Finally, Luxembourg's performance on the geopolitical front is mixed. While it is among the best performers on eight indicators, it is simultaneously one of the worst performing Member States in nine out of the 30 indicators. The country has one of the highest metal footprints per capita in the EU and a large part of its energy is imported. Suppliers' concentration is quite high for base metals such as iron or zinc. Luxembourg's low fertility rate is negative for resilience. The fact that the country also has one of the highest net migration rates does not seem to be factored in. However, the country is also very open to international trade with many ties both inside and outside the EU. Furthermore, Luxembourg has a growing international workforce and one of the highest net-migration rates. Additionally, the employment gap between EU and the non-EU nationals is one of the lowest in the EU.

1.4.3 The EU resilience dashboards: a variation on a theme?

The development of another architecture and governance for measuring resilience needs to be carefully weighted and designed in order to convincingly establish its potential for generating new insights and added value.

When exploring overlaps and novelties in the different approaches, it is useful to compare the EU resilience dashboards (124 indicators) first with the UN SDG monitoring framework defined in the UN Agenda 2030. The following comparison is not based on the full set of the 231 UN indicators but on a subset of 102 EU-specific UN SDG indicators. In fact, UN SDGs have been tailored to the EU with an EU SDG indicator set of 102 indicators (Eurostat, 2021). Their monitoring has been entrusted with Eurostat.

In what comes next, the indicators from the EU Resilience Dashboards are also compared to the set of national sustainability indicators derived from the third National Sustainable Development Plan (MECDD, 2019). This "*Plan national pour un développement durable*" (PNDD) for the period 2018-2030 translates the UN SDGs into the national context. It defines 10 priority fields of action for Luxembourg's government. Progress towards sustainability there is monitored by means of a set of 110 indicators.¹⁷

Finally, the EU resilience indicators are also put in contrast with the annual competitiveness scoreboard (*Tableau de bord de la compétitivité* or *TBCO*) of Luxembourg's Ministry of the Economy. The scoreboard consists of 68 indicators that are exposed in detail elsewhere in the present publication. The aim is to understand the interconnections between the EU resilience dashboards and the national competitiveness scoreboard. This means understanding what they have in common and what distinguishes them. That is conducted also with a view to identify potential areas of adjustments.

The set of indicators in the EU Resilience Dashboards is compared pairwise with each of the three other indicator sets to reveal possible matches. Two indicators are considered to be matching if (a) they are identical, (b) they are very similar with slightly different specifications or (c) they relate to the same concepts or are similar at a conceptual level.¹⁸ This allows one to see what value the resilience dashboards add to the existing monitoring measures and if there are areas that are relatively neglected in some of the existing frameworks.

The results of these cross-comparisons are presented in what follows.

For the "social and economic" dimension, the EU resilience and the **EU SDG frameworks** overlap on 94% of their indicators. The overlap is even greater in the "green" dimension, where every indicator contained in the resilience dashboard is simultaneously represented in the EU SDGs framework.

¹⁷ See STATEC (2018). The full set of PNDD indicators, adopted by the "*Commission interministérielle du développement durable*", is available on STATEC's website under <https://statistiques.public.lu/en/index.html>

¹⁸ The inspiration for this kind of comparison comes from the European Commission itself. A comparison between the indicators from the resilience dashboards and the EU SDGs appears in the appendix to the resilience dashboards (European Commission (2021a)). We take the indicators to be matching if one of the three mentioned criteria apply. The European Commission uses other criteria.

Similarities are less pronounced for the “digital” dimension. Here, 25 out of the 30 indicators in total (80%) have a matching counterpart. Noticeably, those are all conceptual similarities and there is no exact match. The fewest matches between the two indicator sets appear in the “geopolitical” dimension where 60%, that is, 18 of the 30 indicators from the EU resilience dashboards link directly to EU SDG indicators.

Moving on in the comparison, the EU resilience dashboards are compared to the two national frameworks. One relates to sustainability and the other to competitiveness. The **PNDD** set overlaps by approximately 41% (14 out of 34) with the EU dashboard indicators in the “social and economic” domain. The overlap increases to 50% (15 out of 30) in the “green” field. Some disconnect appears in the “digital” and the “geopolitical” dimensions that are not addressed in the PNDD. The **Luxembourg competitiveness scoreboard** overlaps conceptually by 29% (10 out of 34) with the EU social and economic dashboard. Ten indicators out of the 30 that define the “green” dimension in the dashboard (33%) are also found in the scoreboard. The “digital” and “geopolitical” dimensions do not exist in the scoreboard.

Overall, the resilience dashboards overlap the most with the other dashboards in measures of “greenness”, which monitor the environmental impact. The limited overlap in some areas with the national competitiveness scoreboard can be partly attributed to the more general fact that the competitiveness scoreboard contains only 68 indicators, while the resilience dashboards consist of 124 indicators.

Table 1

Synthesis of the overlap between the resilience dashboards and the different indicator sets

OVERLAPS	EU SDG	PNDD	TBCO
Social and Economic Dimension	94%	41%	29%
Green dimension	100%	50%	33%
Digital dimension	80%	0%	0%
Geopolitical dimension	60%	0%	0%

Source: Author’s own visualisation

The findings can be represented graphically. Figure 8 is a visual exposition of the overlaps between the resilience dashboards and the other indicator sets. The circle in the middle of the figure represents the four dimensions of the EU resilience dashboards. The section of the circle that represents the “social and economic” dimension is slightly larger than the other sections since 34 indicators serve to describe that dimension while 30 indicators describe each of the other dimensions.

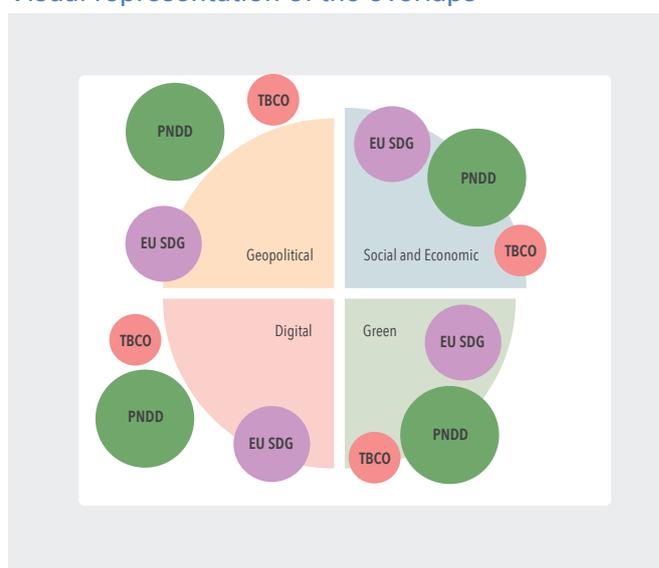
For each dimension, bubbles are used to depict each of the three indicator sets to which the EU dashboard is compared. The sizes of

the bubbles, likewise, represent the sizes of the sets. The larger a set, the bigger the corresponding bubble.

The overlap between the central sections of the circle and the different bubbles represent the extent to which the associated indicators sets are conceptually similar. When a resilience dashboard and an indicator set have nothing in common, then the bubble lies outside of the section. That is for instance the case for the TBCO and the digital resilience dashboard. If there is a partial or complete overlap between the resilience dashboards and the indicator sets, then the bubbles lie partly or fully within the sections of the circle. Hence, since the overlap between the two sets is of 50%, half of the PNDD bubble lies within the “green” area of the EU circle.

Figure 8

Visual representation of the overlaps



Source: Author’s own visualisation; EU resilience dashboards = 124 indicators (Social and economic = 34 indicators; Green = 30 indicators; Digital = 30 indicators); Lux PNDD = 110 indicators; EU SDGs = 102 indicators; Lux competitiveness scoreboard = 68 indicators.

1.5 What does it all mean for Luxembourg? From shocks to stocks?

Overall, there is a significant overlap between the EU resilience dashboards and the EU SDG frameworks. Both measure almost exactly the same things in order to grasp social, economic and green issues.

However, on geopolitical and digital matters, the EU resilience dashboard overlaps only partially with the EU SDGs. There is even a disconnection with the national indicators sets. At a national level, these two dimensions introduced by the EU resilience dashboards are a novelty.

These are currently being debated both publicly and within the network of “Ministries for the Future” that was set up between the European Commission and Member States as part of the EU’s strategic foresight work.

When considering digitalisation, it is widely recognized that the teleworking of up to 2/3 of Luxembourg’s resident workforce allowed a broad range of companies – notably financial and banking ones – to continue to serve their clients during the COVID-19 pandemic. The resilience of global services, based on a robust ICT infrastructure, avoided a sharp economic recession and a surge of unemployment.

However, some scholars question the role of digital technologies in helping to achieve resilience.¹⁹ The digital and green dimensions may be seen to work on different levels (means and ends), or even to be incompatible if digitalisation implies to increase energy and resource uses. There remain open empirical questions. In a disaster situation, do new technologies tend to increase or to decrease vulnerability? Are they disaster-proof? And when are hi-tech ICT solutions preferable to low-tech solutions (ICLEI, 2018)? Planned obsolescence, the rebound effect and technological failures seem to have reinforced rather than mitigated ecological pressures (UNEP, 2011). Indeed the planned obsolescence of devices and online shopping generate significant amounts of waste. Similarly, the power of telecommunication networks and the development of the Internet of Things maintain an exponential growth of energy demand. Digitalisation, which is commonly associated with dematerialisation, has in fact a strong material, carbon, energy and even territorial footprint.

Concerning geopolitical aspects, small, import-dependent and raw material-deprived countries such as Luxembourg appear to be penalised. Luxembourg is highly dependent on the good operation of the European single market. As was developed earlier, Luxembourg is an open economy with a limited number of industrial facilities or skills pools. In that context, it is challenging to avoid a concentration of supplier or value chain partners. An obvious tension also lies in the supply and governance of critical raw materials that are indispensable for technological deployment.

Notwithstanding its exceptionally high international workforce ratio and net-migration rates, Luxembourg managed to keep one of the lowest employment gaps between EU and the non-EU nationals in the European comparison. When looking at the economy’s reliance on non-resident workers from neighbouring and other countries, it is hoped that digitalisation, by delivering on its promise to significantly increase productivity by automation and robotisation, could help reduce this dependency. On the other hand, the country is currently short of high-qualified skills needed to lead the digital transition.

For all these reasons, the case of Luxembourg deserves a special consideration. Small open economies are per se more vulnerable but they also have a higher potential to bounce back in the event of

a shock. A consistent strand of literature on small economies has shown their inherent vulnerabilities.²⁰ Briguglio (2018) argues that **small States**, with limited natural resource endowments, need to have a resilient economy, much more than other groups of countries. For it would pay off for small States to integrate resilience-building measures in their plans and strategies by promoting macroeconomic stability, market flexibility and good social and environmental governance. These measures also enhance competitiveness. For the author, building clusters at the level of resources (such as building materials, water, energy, food...) or regions (such as within the *Grande Région*) is another way for small countries to remain competitive. Clustering can stimulate economies of scale, the sharing of knowledge, access to particular resources while mitigating competition and scale disadvantages.

In the course of designing the EU resilience dashboards, Luxembourg argued in favour of adopting a single market approach to EU resilience since it has mitigating effects on almost all the vulnerabilities identified in the Strategic Foresight Report. The dashboards should better reflect the wide-ranging and well-known cross-border phenomena present within the EU.²¹

The two national frameworks (for sustainability and competitiveness) are as of now unconcerned by the supranational geopolitical and digital dimensions. Their overlap with the European socio-economic dashboard is, however, significant.

By nature, the SDGs and the PNDD indicators overlap greatly. The latter is a national adaptation and synthetic version of the former, reflecting locally available data.

This chapter recognises the importance of resilience but also stresses the importance to adapt the measuring framework in order to better fit the specific circumstances of a small, open economy. A national approach of resilience could be developed together with all the relevant stakeholders, as it has already been the case for issues of sustainability and competitiveness.

Now, what could be expected from a Luxembourg-specific resilience scoreboard?

To avoid an inflation of indicators or the duplication of already existing socio-economic and environmental indicators, the economic resilience scoreboard should be fundamentally distinct from the competitiveness scoreboard, concentrated on a sizeable and absorbable number of indicators, and integrate the specificities of relevant sub-branches of the economy. Junker (2020) develops such a discussion of potential indicators in *Le Luxembourg en 2050*.

It appears that the physical state of the strategic, vital stocks available to “bounce forward better”, that is a fundamental piece of information, is addressed neither by the sustainability framework nor by the resilience framework. This should not be confused with the widespread just-in-time conception of supplying ordinary goods and services. Luxembourg is not self-sustaining when it

19 “The mere introduction of digital technologies alone does not automatically lead to the desired structural change in institutions, organisations or companies. Against the background of the pandemic, however—and aiming for a recovery, which establishes a new ‘normal’—it becomes clear that incremental and cautious innovation steps are far from sufficient. A broader perspective on the social prerequisites of successful implementation and utilisation of digital technologies is absent” (Social Europe, 2021).

20 See for instance the proceedings of the International Conference on *Competitiveness Strategies for the Small States of the EU*, organised in 2018 by the Luxembourg Observatory for Competitiveness, <https://odc.gouvernement.lu/en/actualites/mes-actualites/2018/Conference-Small-States.html>

21 That is in line with the view of Luxembourg’s Ministry of Foreign Affairs, which represents Luxembourg in the EU Commission Foresight unit (2021).

comes to supplying goods to ensure a basic standard of living. The aim here is to improve the security of vital supplies, functions and services over the entire territory and in anticipation of the next crisis. This would include an assessment of the criticality, robustness and redundancy of essential infrastructures or supply chains. Digital tools to optimise inventories and flow management can be useful. The notion of **emergency stock**, supported by the International Energy Agency (IEA) or the EU and widely used in the energy sector, could be an example for developing a broader resilience indicator. Such an indicator might look like something of this sort:

emergency stocks equivalent to at least xx days of imports, for food, fertilisers, seeds, water and water purification products, energy (primary, or as in pumped storage, batteries, gen sets...), medication and health equipment, machinery spare parts...

More consideration could also be given to the enhancement of human capital or the regeneration of natural capital. By human capital it is made reference here to resilience-related issues related to traditional knowledge, psychological, physical and mental health, technical and manual education and training, governance combining State and non-State actors, the continuity of the functioning of the State, time-risk-uncertainty-complexity-anticipation management competences... Regenerated natural capital (rebuilt biodiversity, enhanced carbon sinks, recreated landscapes, preserved genetic resources, restocked woodlands and water resources, restored soils and fishing grounds, etc) could act as a back-up or buffer in the face of disaster.

Given the smallness of Luxembourg's territory, other resilience indicators to consider may include the number of persons fed in a healthy and regenerative manner from one hectare of land or the status of habitat fragmentation. As for economic resilience, it might be interesting to reconsider the indicator of "economic losses from environmental pressures and climate related events", proposed in 2020 by the prototype EU dashboards (European Commission 2020).

This chapter has shown that, just like for the concepts of sustainability, transition or transformation, resilience thinking and practice depend on perceptions, values and cognition. In order to objectify resilience and make it more palpable, this chapter finds that it would be useful for the resilience indicator framework to:

- Be based on clearly stated underlying assumptions, definition of resilience and characteristics of the transformation to be conducted;
- Add value by being clearly articulated to other existing, thematically similar, multi-dimensional, supra-national frameworks;
- Be adapted to local contexts and national particularities;
- Be tied up with realistic expectations;
- Address the occurrence of extreme events, emergency responses, vital functions, goods and services, in a context of growing uncertainty and risks.

At a national level, a next step would be to stimulate a broader discussion on the general concept of resilience, its underlying assumptions, the change it is to bring about and the ways to apply it in Luxembourg. In conjunction with STATEC, Luxembourg Strategy, the foresight unit of the Ministry of the Economy, proposes to initiate this process with all the stakeholders involved. Luxembourg Strategy, created in November 2020, assists the Ministry in its long-term strategic planning efforts and in its design of a resilient pathway for the economy by 2050. Megatrend analysis, scenario-building, biophysical stress tests and modelling are ways to cement the ongoing debates. In that context, the annual Competitiveness and Resilience Report of the Ministry may prove to be a suitable platform to feedback on the evolution of the analysis and contribute to a national consensus building around the concept of resilience.

1.6 References

- Ali Malik, H., & Saxena, S. (2021). *Resilient Economies are Possible*. Retrieved 11 04, 2021, from UN ESCAP: <https://www.unescap.org/blog/resilient-economies-are-possible>
- American Psychological Association. (2021). Retrieved 10 21, 2021, from <https://www.apa.org/topics/resilience>
- Bartolini, S., Sarracino, F. (2021). Happier and Sustainable. Possibilities for a post-growth society, 15 June 2021, <https://mpraub.uni-muenchen.de/108309/>
- Briguglio, L. (2016). "Exposure to external shocks and economic resilience of countries: evidence from global indicators." *Journal of Economic Studies* 43(6): 1057-1078.
- Briguglio L., Vella M. (2018), University of Malta, Presentation prepared for the Conference: Competitiveness Strategies for the EU Small States, Ministry of the Economy, Observatory for Competitiveness, Luxembourg, 19-20 April 2018, <https://odc.gouvernement.lu/dam-assets/actualit%C3%A9s/events/2018/conference-small-states/session-4-4-briguglio-vella.pdf>
- Brinkmann, H., Harendt, C., Heinemann, F., & Nover, J. (2017). Ökonomische Resilienz – Schlüsselbegriff für ein neues wirtschaftspolitisches Leitbild. *Wirtschaftsdienst*, 97, 644-650.
- CBD. (2021). *Traditional knowledge and the Convention on Biological Diversity*. Retrieved 11 09, 2021, from Convention on Biological Diversity: <https://www.cbd.int/traditional/intro.shtml>
- Comfort, L. K., Boin, A., & Demchak, C. (2010). *Designing Resilience. Preparing for Extreme Events*. Pittsburgh: University of Pittsburgh Press.
- European Commission. (2020a). *2020 Strategic Foresight Report*. Retrieved 10 21, 2021, from <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1601279942481&uri=CELEX%3A52020DC0493>
- European Commission. (2020b). *A Strong Social Europe for Just Transitions*.

- European Commission. (2021a). *Resilience Dashboards annex*. Retrieved 10 21, 2021, from https://ec.europa.eu/info/publications/resilience-dashboards-report-and-annex_en
- European Commission. (2021b). *Resilience Dashboards Report*. Retrieved from https://ec.europa.eu/info/publications/resilience-dashboards-report-and-annex_en
- European Parliament. (2020). *Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088*. Retrieved 10 21, 2021, from <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32020R0852&qid=1634024223632>
- Eurostat. (2021). *SDG Indicators: Goal by Goal*. Retrieved 10 26, 2021, from Eurostat: <https://ec.europa.eu/eurostat/web/sdi/indicators>
- Fang, K. (2021). Moving away from sustainability. *Nature Sustainability*.
- Fanning, A. L., O'Neill, D. W., Hickel, J. et al. (2021). The social shortfall and ecological overshoot of nations. *Nature Sustainability*.
- Folke, C., Biggs, R., Norström, A. V., Reyers, B., & Rockström, J. (2016). Social-ecological resilience and biosphere-based sustainability science. *Ecology and Society*.
- Hallegatte, S. (2014). *Economic Resilience – Definition and Measurement*. The World Bank – Climate Change Group – Office of the Chief Economist. Retrieved from <https://openknowledge.worldbank.org/bitstream/handle/10986/18341/WPS6852.pdf?sequence=1&isAllowed=y>
- Harendt, C., & Heinemann, F. (2018). *Resilienz von Staaten gegen Aussenwirtschaftskrisen*. Gütersloh: Bertelsmann.
- Holling, C. S. (1973). Resilience and stability of ecological systems. *Annual review of ecology and systematics*, 1-23.
- Holling, C. S. (1996). Engineering Resilience versus Ecological Resilience. In N. A. Engineering, *Engineering Within Ecological Constraints* (pp. 31-43). Washington, DC: The National Academies Press.
- Hölscher, K., Wittmayer, J. M., & Loorbach, D. (2018). Transition versus transformation: What's the difference? *Environmental innovation and societal transitions*, 27, 1-3.
- Jancovivi, J.-M., Lepousez, V., Mallet, C., Mossé, J., Aboukrat, M., & Girard, T. (2021). *Référentiel d'analyse de la résilience climatique des entreprises*. Retrieved 10 21, 2021, from <https://www.carbone4.com/guide-methodologique-ocara>
- Junker, P. (2020). *Le Luxembourg en 2050. De l'aménagement au ménagement du territoire. Pour un Territoire décarboné, circulaire et résilient, Luxembourg 2020*.
- JRC. (2018). *The resilience of EU Member States to the financial and economic crisis: What are the characteristics of resilient behaviour?* Luxembourg: Publications Office of the European Union.
- Le Blanc, A., & Zwarterook, I. (2013). *Introduction à la résilience territoriale: Enjeux pour la concertation*. Toulouse: Foundation for an Industrial Safety Culture. Retrieved from <https://www.foncsi.org/fr/publications/cahiers-securite-industrielle/introduction-resilience-territoriale-enjeux-concertation/CSI-GRIZ-resilience-territoriale.pdf>
- Liao, K.-H. (2012). A Theory on Urban Resilience to Floods – A Basis for Alterhative Planning Practices. *Ecology and Society*.
- Manca, A. R., Benczur, P., & Giovannini, E. (2017). *Building a Scientific Narrative Towards a More Resilient EU Society Part 1: a Conceptual Framework*. Luxembourg: Publications Office of the European Union.
- Marchese, D., Reynolds, E., Bates, M. E., Morgan, H., Calrk, S. S., & Linkov, I. (2018). Resilience and sustainability: Similarities and differences in environmental management applications. *Science of the total environment*, 1275-1283. Retrieved from <https://www.sciencedirect.com/science/article/abs/pii/S0048969717324282?via%3Dihub>
- Mathevet, R., & Bousquet, F. (2014). *Résilience & Environnement, Penser les changements socio-écologiques*. Paris: Buchet Chastel.
- MECDD. (2019). *Développement durable*. Retrieved 10 26, 2021, from emwelt.lu: <https://environnement.public.lu/fr/developpement-durable.html>
- Merriam-Webster. (2021). Retrieved 10 21, 2021, from <https://www.merriam-webster.com/dictionary/resilience>
- National Geographic. (2021). *National Geographic*. Retrieved 10 21, 2021, from <https://www.nationalgeographic.org/encyclopedia/anthropocene/>
- OECD. (2013). *OECD*. Retrieved 10 21, 2021, from <https://www.oecd.org/dac/May%2010%202013%20FINAL%20resilience%20PDF.pdf>
- OECD. (2020). *A systemic resilience approach to dealing with Covid-19 and future shocks*.
- OECD. (2021). *Fostering Economic Resilience in a World of Open and Integrated Markets – Risks, Vulnerabilities and Areas for Policy Action*.
- OECD. (2021). *Progress Report on hte Development of an OECD Dashboard to Monitor a Strong, Resilient, Green and Inclusive Post-COVID-19 Recovery*. Retrieved 10 21, 2021, from <https://www.oecd.org/mcm/Progress%20Report%20on%20the%20development%20of%20an%20OECD%20Dashboard%20to%20Monitor%20a%20Strong,%20Resilient,%20Green%20and%20Inclusive%20Post-COVID-19%20Recovery.pdf>

Raworth, K. (2012). *A safe and just space for humanity. Can we live within the Doughnut? Oxfam Discussion Paper*. Retrieved from https://oi-files-d8-prod.s3.eu-west-2.amazonaws.com/s3fs-public/file_attachments/dp-a-safe-and-just-space-for-humanity-130212-en_0_4.pdf

Reghezza-Zitt, M., Rufat, S., Diament-Tran, G., Le Blanc, A., & Lhomme, S. (2012). What Resilience is not: Uses and Abuses. *European Journal of Geography*.

Southwick, S. M., Bonanno, G. A., Masten, A. S., Panter-Brick, C., & Yehuda, R. (2014). Resilience definitions, theory, and challenges: interdisciplinary perspectives. *European Journal of Psychotraumatology*. doi:<https://doi.org/10.3402/ejpt.v5.25338>

STATEC. (2018). *Développement Durable au Luxembourg*. Luxembourg: STATEC. Retrieved 10 26, 2021, from <https://statistiques.public.lu/en/news/territory/environment/2018/09/20180927/index.html>

Steffen, W., & al., e. (2015). Planetary Boundaries: Guiding Human Development on a Changing Planet. *Science*, 347(6223).

Stockholm Resilience Centre. (2015). *Stockholm Resilience Center*. Retrieved 10 21, 2021, from <https://www.stockholmresilience.org/research/research-news/2015-02-19-what-is-resilience.html>

Tendall, D., Joerin, J., Kopainsky, B., Edwards, P., Shreck, A., Le, Q., ... Six, J. (2015). Food system resilience: Defining the concept. *Global Food Security*, 17-23.

UN Secretary General. (1987). *Report of the World Commission on Environment and Development: Our common future*. Retrieved 10 21, 2021, from <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf>

UNEP. (2011). Decoupling natural resource use and environmental impacts from economic growth, A Report of the Working Group on Decoupling to the International Resource Panel

UNDP. (2020). *The 2020 Human Development Report*. New York: United Nations Development Programme.

UNDRR. (2015). *Sendai Framework for Disaster Risk Reduction 2015-2030*. Sendai.

United Nations. (2017). *Resolution adopted by the General Assembly on 6 July 2017*. Retrieved 10 21, 2021, from https://ggim.un.org/documents/A_RES_71_313.pdf

Villar, C., & David, M. (2014). *Cerema*. Retrieved 10 21, 2021, from <https://www.cerema.fr/fr/actualites/resilience-outil-territoires>