To : Editor
Dr. Maria Bostenaru Dan

Subject: third revision of a manuscript entitled "Critical Infrastructures Resilience: A Guide for Building Indicator Systems. Based on a Multi-Criteria Framework with a Focus on Implementable Actions".

First manuscript submitted on January 24 2024	Second manuscript submitted on July 22 2024

Paris, August 2 2024

Dear Dr. Maria Bostenaru Dan,

Thanks a lot for your reply and for giving us suggestions to improve this manuscript.

Based on your comments, the third revision focuses mainly on the introduction. Firstly, it has been restructured and it now contains three paragraphs
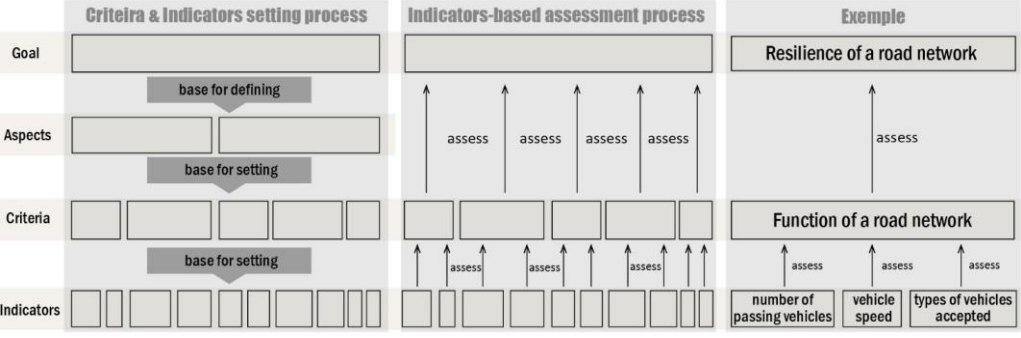
1.   A short presentation of resilience assessment based on indicators.
2.   Research gap definition through a brief literature overview.
3.   Research questions, objectives, and assumptions.

Secondly, Figure 1 (original version) explaining the assessment process has been removed as its contents have been shown in Figure 3 and Figure 12 (revised version). This study concentrates on building indicator systems for resilience assessment. Therefore the processes of resilience assessment and indicators assessment have been moved to the discussion, i.e. section "5.2 Assessment demonstration".

In addition, some of the figures have been optimised, and grammatical mistakes have been corrected. Please find the detailed revisions in the following tables. All your comments are in green and all highlight revisions are in red.

Thanks again for your valuable comments provided.
Looking forward to receiving your reply.

Best regards,
Authors.

Issue : Figure 1	
Comment	
Reply	Figure 1 (original version) explaining the assessment process has been removed as its contents have been shown in Figure 3 and Figure 12 (revised version). This study concentrates on building indicator systems for resilience assessment. Therefore the processes of resilience assessment and indicators assessment have been moved to the discussion, i.e. section "5.2 Assessment demonstration".
Revision 1 **Section 1: Introduction**	**Removed** *(red)* The research for Critical Infrastructures (CIs) goes across disciplines, sectors, and scales, as the disruption or destruction of CIs would have a significant cross-border impact on human society. However, …. CIs resilience is frequently based on indicators (Hosseini et al., 2016; Mebarki, 2017; Cantelmi et al., 2021). ~~Indicator-based resilience assessment could be simply summarised as a process consisting of three factors and two phases, as shown in Fig. 1 (Yang et al., 2023, a):~~ 　　― ~~Indicator assessment: a process in which indicator values are obtained by reliable data.~~ 　　― ~~Resilience assessment: a process in which resilience values are obtained by usable indicators;~~ ~~The methods based on indicators transform data into indicators, and from indicators derive the global value of the so-called resilience. Such methods, considering both resilience and indicators assessments, are diverse and multidisciplinary. Some are quantitative, other are qualitative, and some are semi-quantitative (Hosseini et al., 2016; Mebarki, 2017; Yang et al., 2023, a).~~ ~~**Fig. 1. Indicator-based Resilience Assessment, source: Yang et al. (2023, a).**~~
Revision 2 **3.1 Specific criteria setting**	**Modified** *(red)* Assessments consisting … is divided into aspects or themes, which are in turn divided into criteria each with several indicators (Maggino, 2017). The assessment process (Fig3. Indicators-based assessment process) is from "indicators" to "goals", but criteria and indicators (Fig3. Criteria & Inidcators setting process) are set in the opposite direction. This means that the …. in the present paper should enable managers to set specific criteria for adapting to different real cases. **Fig. 3. A hierarchical structure in multi-criteria approaches for C&I-based assessment, adjusted from Yang et al. (2023, b).** 　　➔ Assessments consisting … is divided into aspects or themes, which are in turn divided into criteria each with several indicators (Maggino, 2017). Criteria and indicators (Fig. 2, Criteria & Indicators setting process) are set from "goal" to "indicator". The assessment process (Fig3. Indicators-based assessment process) is from "indicators" to "goals", but criteria and indicators (Fig3. Criteria & Inidcators setting process) are set in the opposite direction. This means that the …. in

the present paper should enable managers to set specific criteria for adapting to different real cases. In contrast to the "Criteria & Indicators setting process", the assessment process (Fig. 2, Indicators-based assessment process) based on an indicator system transforms indicators into criteria levels, and from criteria levels derive the resilience value.
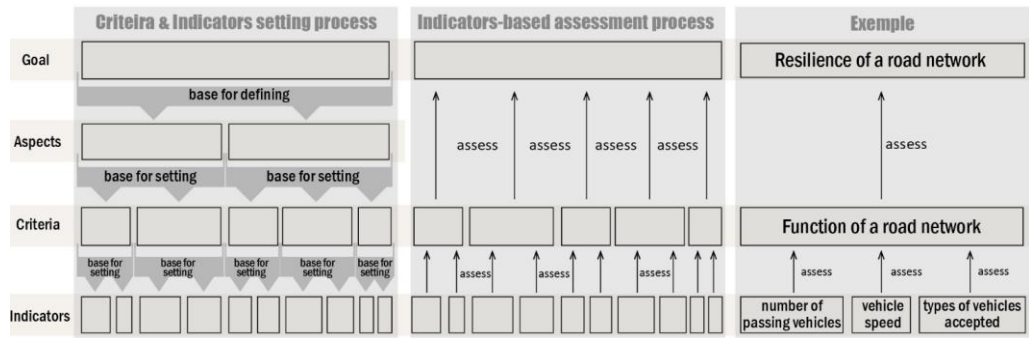
Fig. 2. A hierarchical structure in multi-criteria approaches for C&I-based assessment, adjusted from Yang et al. (2023, b).

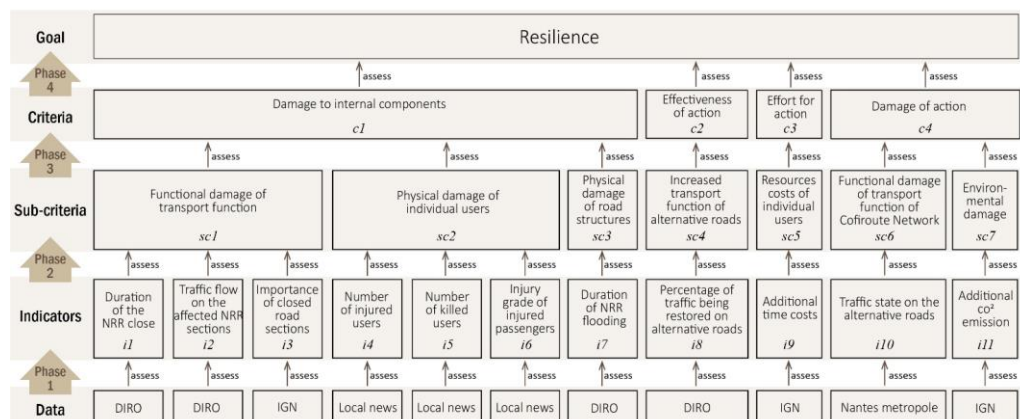|	
Revision 3 **5.2 Assessment demonstration**	**Modified** *(red)* This study aims … ~~As shown in Fig. 1,~~ resilience could be assessed based on indicators, and indicators could be assessed based on reliable data. ➜ This study aims … As presented in the introduction, resilience could be assessed based on indicators, and indicators could be assessed based on reliable data.
Revision 4 **5.2.2 Assessment methods and results**	**Added** *(red)* Assessment could be quantitative, qualitative and semi-quantitative … ➜ Resilience assessment, criterion level assessment and indicator assessment could all be quantitative, qualitative and semi-quantitative ….The resilience assessment process based on this built indicator system, for the studied scenarios (Fig.10) focusing on Nantes Ring Road, includes potentially 4 phases (Fig. 12): 1. Indicator assessment based on collected data; 2. Assessment of the level of sub-criteria based on indicators; 3. Assessment of the level of criteria based on the level of sub-criteria; 4. Resilience assessment based on the level of criteria. **Fig 12. Assessment process of Nantes Ring Road resilience based on the indicator systems developed in present study, created by authors.**

Issue : structure of introduction	
Comment	The introduction shall contain a brief literature overview with knowledge gap, the research questions, hypotheses, and limitations and assumptions.
Reply	The introduction has been restructured and it now contains three paragraphs 1. A short presentation of resilience assessment based on indicators. 2. Research gap definition through a brief literature overview. 3. Research questions, objectives, and assumptions.
Revision 1 **Section 1:** **Introduction**	**Reorganised** *(red)* The research for Critical Infrastructures (CIs)… Moreover, the assessment of CIs resilience is frequently based on indicators (Hosseini et al., 2016; Mebarki, 2017; Cantelmi et al., 2021). Indicator-based resilience assessment could be simply considered as a process in which resilience values are derived from indicators. Furthermore, the indicator values could be obtained by reliable data. To generate increasingly precise information on conditions, the assessment designed for a complex system …. Moreover, the review of Yang et al. (2023, a) shows that many studies about CIs resilience criteria setting have focused on the damages to CIs or CIs capabilities related to resilience, but have overlooked the fact: the benefits, costs or impacts of implementable actions for every CIs manager are critical. The lack of discussion and consensus about the effects of implementable actions causes the application difficulties of CIs resilience assessment in practical management. Therefore, as a contribution to fill the gap, the present study aims to provide a guide for CIs managers to enable them to build specific indicator systems tailored to their specific case studies. This developed guide considers not only damages to CIs and CIs capabilities, but also the benefits, costs or impacts of implementable actions. This developed guide considers not only damages to CIs and CIs capabilities, but also different factors of implementable actions. To achieve the objectives of this study, an immediate question is: which achievements should the developed guide assist the user in accomplishing? Another fundamental question necessitates deliberation: what should the developed guide contain to enable users to reach these achievements? For the first question, according to many studies focusing on indicator systems building (Lammerts Van Bueren and Blom, 1997; Vogel, 1997; Prabhu et al., 1999; Mendoza and Prabhu, 2000), the setting of Criteria & Indicators (C&I), and the collection of data are considered basic (Cutter, 2016; CORDIS-Smart Resilience Indicators for Smart Critical Infrastructures, 2018; Balaei et al., 2018). In particular, the criteria and indicators adapted to real cases are the key for CIs managers to apply indicator systems to practical management (Yang et al., 2023, b). For the second question, practical guides should include guidance on operational steps, required resources, as well as advice for finding required resources. Therefore, the developed guide should contain operational steps and resources finding advice that help CIs managers set specific Criteria & Indicators and collect data. Furthermore, for the indicator system to be applied in practical management, the developed guide in this study should consider the benefits, costs or impacts of implementable actions. This present study assumes that the developed guide can help CIs managers build indicator systems and attempts to illustrate its use and usage through an example.

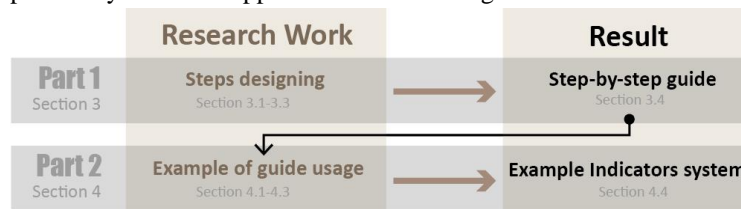|	
Revision 2 **Section 2: Research Method and Structure**	**Removed to the introduction (*red*)** ~~To achieve the objectives of this study, an immediate question is: how to develop a guide that enables CIs managers to build specific indicator systems for assessing CIs resilience? Practical guides should include guidance on operational steps, and required resources. Therefore, the steps, as well as the advice for finding required resources, are anticipated in the objective guide. Another fundamental question necessitates deliberation: which achieves should the objective guide assist the user in accomplishing? Many studies, such as those carried out by Lammerts Van Bueren and Blom (1997), Prabhu et al. (1999), and Mendoza and Prabhu. (2000), consider that the usable criteria and indicators adapted to the specific needs of stakeholders are the key to applying indicator systems to practical management. Moreover, several studies believe that data analysis should not be missed during the indicators based assessment (Vogel, 1997; Prabhu et al. 1999; Cutter, 2016; CORDIS Smart Resilience Indicators for Smart Critical Infrastructures, 2018; Balaei et al., 2018). Therefore, criteria, indicators and data are the indispensable contents of an indicators system. For building an indicator system, the setting of Criteria & Indicators (C&I), and the collection of data are considered basic.~~ This research could start with a presentation of the three basic key factors (criterion, indicator and data). Then, the main research work is designing the steps for C&I setting and data collection (Fig.2). Moreover, for these steps to be better operational in practice, the steps designed in this guide should be clearly described and preferably with the support of schematic diagrams. **Fig. 2. Methodology and structure of the present study, created by authors.** ….. ➔ Based on the presented research objectives and questions, this research could start with a presentation of the three basic key factors (criterion, indicator and data). Then, the main research work is designing the steps for C&I setting and data collection (Fig. 1). Moreover, for these steps to be better operational in practice, the steps designed in this guide should be clearly described and preferably with the support of schematic diagrams. **Fig. 1. Methodology and structure of the present study, created by authors.**