# Functional Quality:

## A Use-case Oriented Data Quality Evaluation

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***Abstract*—The current paradigm in geospatial data quality is datacentric (internal quality), but it can be overcome by considering generic use cases that link geospatial data with its processing (algorithms). The new approach proposed by the functional quality supposes an intermediate situation between the user's and producer's perspectives (external and internal quality). This paper defines the functional quality and explains the need for this new perspective.**

***Keyords-Data quality; fitness for use; functional quality.***

## I. INTRODUCTION

The concept of quality is close to everyone, it is used in colloquial language and is universally understood and intuitively accepted. In general, it can be said that a well-done work has quality. The term quality is defined in [1] as the degree to which a set of inherent characteristics of an object fulfils requirements. This definition clarifies that quality does not have to be limited to a single property of the object under consideration, but that several factors may come into play to define quality. On the other hand, what is inherent is what is proper or inseparable from things, and it is worth clarifying that here are factors that are more evident, or explicit, than others that have a more implicit character. Another interesting aspect of this definition is the one that quality refers to the fulfillment of requirements.

In this way, it is interesting to define what fitness for use is. If we go to the American Association for Quality glossary on quality [2], it tells us that fitness for purpose is a «term sometimes used to define the term "quality", to indicate the degree to which a product or service meets the requirements for its intended use». In the Online Browsing Platform of ISO, there is no direct entry for this term, although as a related entry appears «test or usability test», which is defined as «test to determine if an implemented system fulfills its functional purpose as determined by its users». All of the above means that the use of the term "fitness for use" implies having: i) a well-determined purpose of use and ii) the ability to evaluate the performance level. In this work, we will focus on the first aspect of the previous two. In relation to the first component, use cases can be considered. Basically, a use case is nothing more than the description of an action or process with a certain level of formalization (e.g., using Unified Modeling Language diagrams, or any other language). Focused on a specific user requirement, the documentation of a use case must include the actors, actions, inputs, outputs and decisions necessary to achieve the prosed goal. The fitness for use approach supposes the loss of the most transcendent, abstract and general vision of quality to focus on specific use cases. For example, in the automobile sector, there are many possible users, uses and ways of driving a specific vehicle model. Considering that for a user the fuel consumption is a relevant aspect of the quality of a car model, and that it is impossible to adequately inform for all possible situations, standards, such as the New European Driving Cycle (NEDC) [3], and more recently the World Harmonized Light-duty Vehicle Test Procedure (WLTP) [4], have been adopted for dealing in this complex scenario. In the latter, a driving dynamic is adopted that tries to reproduce much better how people drive in the real world [5]. Closer to the geospatial world, there is experience in performing functional tests on web services (semantic services [6], geospatial services [7] such as WFS, WCS, etc.). And, more generally, the OASIS model [8] for web services establishes several quality dimensions on functional aspects.

For all these reasons, we consider that proposing the perspective of functional quality applied to the case of geospatial data is in line with what is already a reality in more advanced fields.

In the case of geospatial data, there are many references (e.g., [9][10]) that indicate that the quality of geospatial data is something that is not really understood by the data users. On the one hand, quality is poorly communicated and on the other, it does not serve the interests of users because quality is typically reported from a producer and data-centric perspective (e.g., ISO 19157) [11], not usage-centric. The functional quality perspective will help avoid this undesirable situation.

The objective of this work is to develop a new perspective of the quality of geospatial data, in which we are guided by the example previously exposed for the automobile sector. We propose that quality be defined and evaluated in specific use cases, which means linking data and processes (algorithms). In this way we get much better approximation to the fitness for use. We call this new perspective functional quality.

The structure of the paper is as follows: Section 2 defines functional quality in more detail. Section III discusses the

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advantages and disadvantages of this new perspective. Finally, Section IV presents a brief conclusion.

## II. DEFINING THE FUNCTIONAL QUALITY

Given the disaffection that affects users regarding the quality of the data they use due, among other reasons, to the fact that the way in which it is reported does not come close to their real needs, this paper proposes the adoption of a new level of analysis and information on the quality of geospatial data, which we call functional quality. We describe quality with the adjective functional since we propose evaluate how well the data "works" in specific use cases.

Since geospatial data is used in processes, this new level of quality assessment and reporting picks up on this, linking data with algorithms to more fully consider the quality of outputs, which most directly affects to users. Thus, we define functional quality as the consistency, against a reference, of the results generated by a given algorithm when applied to a given geospatial data set (e.g., a given digital elevation model —DEM— dataset that is used for the determination of a hydrographic network).

We understand the functional quality as a new perspective that can be complex and must be defined by various indices (quality measures). For example, for the case of a drainage network determined on a DEM dataset and a given algorithm, some aspects that can help to inform about the functional quality of the DEM are: displacements of the resulting network, completeness of the obtained network, topological problems present in the network, etc. That is to say, aspects that may be of interest to a user who will use that drainage network in their production processes or decision making.

Therefore, functional quality approximates the “fitness for use”, but focused on a use case defined as generic and not considering particular requirements of some users or others (for example, for an engineering project, resolution requirements are different for the phases of feasibility study, preliminary design and project). With all this, a certain component of particularity is eliminated, as occurs when applying the NEDC and WLTP methods for assessing the fuel consumption in specific driving scenarios.

So, functional quality can be considered as the middle layer of a three-layer system, each of which brings us closer to quality from a different perspective: internal quality (the data-centric traditional producer’s perspective), functional (use-case-centric perspective) and external quality (fitness for use perspective). In this way, a more general approach to use cases can be made without going into the problem of countless users and specific conditions of their applications, which supposes a context that is too rich and broad to be addressed. Basically, we are following the same scheme that has been mentioned previously for the case of the automobile sector with respect to the information on vehicle consumption.

## III. DISCUSSION

Before adopting a new perspective, it is worth thinking about whether or not it brings advantages over the previous situation. ISO 19157 establishes the framework for geospatial data quality. In this international standard, the concept that is closest to functional quality is the quality element called “usability”. In ISO 19157, this quality element does not have a clear formulation and is not linked to use cases or algorithms, which is a relevant aspect of functional quality. A better explanation is given in ISO 25010, but there is no formal description. Obviously, the above can make difficult to establish a link with a (semi-)formal description of specific use cases as proposed by us.

In our view, the advantages of working with functional quality are several. Functional quality links the data to the essence of the processes (algorithms), and to applied use cases. All this has a more applied vision and vocation than the internal quality reported by the producers. Internal quality is much more data-centric, focused on the data itself, without considering its use. As functional quality remains linked to use cases by means of algorithms, functional quality provides a greater degree of specificity and always refers to the pair: *FQ = Function {given data set, given algorithm}*. That is, the algorithm is always present as a characteristic of the considered use case. In this way functional quality can provide valuable information to producers and users. For the former, it focuses on the applied interests of users and offers producers information so that they can improve their data quality definition and geospatial data, since now they will better understand the impacts on the final results. For the latter, it offers a more user-centric quality, focused on the use problems that they actually have when using the data, which makes it more understandable, interesting and valuable. In addition, this way of reporting quality is a wake-up call to those users who do not pay much attention to the processing algorithms and who consider that every digital result is good in itself. Finally, given that there are very common use cases and algorithms, the definition and evaluation of functional quality could be standardized for these cases, which would offer greater confidence and transparency.

An aspect that is also relevant in the understanding data, their quality and use, is the quality of the metadata. Functional quality could also be assessed in the metadata. In any case, functional quality should be included in the metadata, which would represent a clear improvement in terms of making them more understandable and practical for users.

## IV. CONCLUSION

The main contribution of this work is conceptual and has focused on justifying the need to introduce a new level of quality assessment (functional quality), which is more informative for users but, at the same time, can be applied by producers. Based on what is already being done in other fields (e.g., vehicles and web services), we consider that adopting the perspective of functional quality is a natural evolution for the case of data and its processes.

This new level of evaluation is intermediate between quality, as it is currently understood and materialized by producers, and quality in the sense of “fitness for use”. Functional quality links geospatial data with its processes, so it offers a way that is much closer to users and can help

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producers to be more attentive to user's needs. In the near future we will continue to develop complete illustrative examples and show the advantages of the use of the functional quality.

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