Appendix III: Evaluation Questionnaires for Ireland pilot case

WP5 - T5.3 Learning from the case studies

Important information

The questionnaire will be based from each case study's lessons learnt report. Please read the selected report thoroughly before completing this questionnaire. The questionnaire should take approximately 2 hours to complete. The questions which are labelled with an (*) are required fields.

Due to the variation in methodological approaches and lessons learnt reports, some questions might be more suited to one case study than others, and some questions may not apply to certain case studies. If a question does not apply to a case study, please explain why.

***Name:**	**Harri Williams**
***Organisation:**	**BRGM**
***Date:**	**07.09.2021**
***Case study evaluating *(please highlight)*:**	**Ireland**

Structural Framework

Do you agree with the following statements? :

1. * *In this case study, the structural framework has been successful in making the geology of the area more understandable.*

☐ Strongly disagree | ☐ Somewhat disagree | ☐ Somewhat agree | ☒ Strongly agree

* Please explain the reason for your choice in a few sentences.

The geology of the entire country of Ireland is very complex.

Features which wouldn't usually be prominent or obvious on a 'traditional' geological map are shown within the SF. Basin structures otherwise covered by sedimentary overburden are displayed. Large scale structures are also more prominent within the SF than a traditional geological map where the 'noise' of smaller faults within complex geological areas are removed.

The SF removes the need for an understanding of lithology descriptions and enables a less informed audience to understand the geology of an area.

The SF provides a pre interpreted, simplified and interactive geological map which is sucesful in making the geology of Ireland more understandable.

2. * *In this case study, the structural framework has been successful in providing a coherent geological context for subsurface applications.*

☐ Strongly disagree | ☒ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences.
No links of utilizing the SF for subsurface planning are mentioned in the report. Due to the large scale involved, further detail would be required in order to determine site specific areas of subsurface planning.

3. **In this case study, the structural framework can aid in identifying and/or resolving subsurface management issues? E.g direct/indirect conflicts of use; zones of influence; areas of potential reuse and synergies; potential hazards etc… (please discuss multiple options if necessary)*.

☐ Strongly disagree | ☒ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences.
The SF developed by GSI is more of an interactive geological map which focuses on carboniferous formations and structures. Subsurface characterization and therefore the identification of subsurface management issues has not been achieved.

4. * *In this case study, what issues/barriers do you identify in applying the structural framework methodology? e.g large scale, large amounts of geological data, time consuming etc…*

* Please explain your answer in a few sentences.

The report states that the construction of the SF was a simple process however differences in the interpretation of data while constructing the SF can have large implications in the final result. E.g decisions by the designer on what they want to leave out or display.

A national scale structural framework may be too coarse a tool for subsurface planning applications.

5. * *In this case study, have you identified any fundamental issues / show stoppers / limitations regarding the application of the structural framework?*

* Please explain your answer in a few sentences.

The large coastal areas proved a problem, where it was difficult to unify features which conjoined over the coastal boundary due to the different sourcing materials of the formations.

Another problem is that folding cannot be displayed on the SF. Some areas of Irelands geology is controlled by folding and therefore not showing folding will leave the SF unfinished.

The large scale of the SF make it difficult to determine specific areas of subsurface development.

6. *Do you have any further recommendations / suggestions which would benefit the application of the Structural Framework in this case study?*

Please explain the reason for your answer in a few sentences.

Try now to use the SF in order to identify areas of promising subsurface development / identify areas of potential synergy.

OR use this SF in order to identify an area where a smaller scale, more detailed SF can be produced in order to try and identify the above. – Where do you think this area would be?

Geomanifestations

Do you agree with the following statements :

7. * *In this case study, geomanifestations have been successful as specific expressions that identify ongoing or past geological processes:*

☐ Strongly disagree | ☒ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences. The selected Geomanifestations do determine past ongoing geological processes however care must be taken when interpreting this data. No useful patterns in mineral deposition were identified. There was a lack of data regarding hot springs and a proficient analysis cannot be made.

8. * *In this case study, geomanifestations have been successful in improving/completing the geological understanding:*

☒ Strongly disagree | ☐ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences.

It cannot be determined from the report if geomanifestations were successful in completing our geological understanding.

9. *In this case study, was the incorporation of Geomanifestations successful in helping identifying specific/potential management issues in the subsurface? E.g direct/indirect conflicts of use; zones of influence; areas of potential reuse and synergies; potential hazards etc… (please discuss multiple options if necessary).*

* Please explain your answer in a few sentences.

From the lack of data given in the repot to determine the successfulness of the GeoM, this question cannot yet be answered.

10. * *In this case study, what are the issues/barriers concerning the application of Geomanifestations? e.g large scale, large amounts of geological data, time consuming etc…*

* Please explain your answer in a few sentences.

Lack of data in certain datasets e.g hot springs

GeoM data was taken from the Geological Survey Ireland and the Irish National Seismic Network only. The utilisation of a larger number of datasets could have retrieved data which was more complete.

Further issues regarding the applicatrion of the SF and the GeoM are discussed below.

11. * *In this case study, have you identified any fundamental issues / show stoppers regarding the application of the Geomanifestations?*

*Please explain your answer in a few sentences.

Geomanifestatoins have been plotted however due to minimal data sets, no concrete patterns have been determined.

Using such a large scale has meant that it is unlikely that any specific patterns will be identified.

12. *Do you have any further recommendations / suggestions which would benefit the application of the Geomanifestations in this case study?*

Please explain the reason for your answer in a few sentences.

Use GeoM on a smaller scale.

Get data from more databases.

Structural Framework and Geomanifestations integration

Do you agree with the following statements :

13. * *The structural framework model annotated with geomanifestations enhances our understanding of the subsurface*

☐ Strongly disagree | ☒ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences.

Due to the fact that the sctructural framework is based from carboniferous basin and shelf features, trends related to GeoM such as mineral deposits which are not related to the carboniferous do not display any relationship to the SF.

SF is at a too greater scale to benefit from GeoM.

14. * *The Structural Framework benefits from the incorporation of Geomanifestations into the model*

☐ Strongly disagree | ☒ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

Please give additional information if necessary.

The SF and GeoM were produced independently from eachother. For the methodology to work in harmony, a SF should be built in line with the specific GeoM on mind. The report states: '…a structural framework built to interpret karst features of a particular catchment would focus on facies and faults of all sizes, rather than basin forming faults at regional scale.'

This would ensure that both methodologies are produced in

15. * *The Geomanifestations benefit from the context of the Structural Framework*

☒ Strongly disagree | ☐ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

Please give additional information if necessary.

Geomanifestations without the context of the SF would be very difficult to interpret.

16. **What barriers prevent both methodologies working (efficiently) together?*

* Please explain your answer in a few sentences.

As described above, the selection bias associated with the construction of the SF as well as the separated nature of both methodologies has prevented both from working effectively together.

17. *Overall, has the methodology been applied successfully within the selected area, fulfilling the aims it set out to achieve? Please give a rating out of 10 and offer a brief explication in the box below.*

'The prime aim of GeoConnect³d is the conversion of geological data into subsurface information and critical parameters that can be used for various geo-applications, decision-making and subsurface spatial planning.'

☐	☐	☐	☐	☒	☒	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9	10

*Please explain the reason for your answer in a few sentences.

The application of the SF has worked very well. Although it has not found any specific purposes for subsurface management, it has developed a method of simplifying a broad amount of geological data, providing a better context to develop subsurface applications. The same methodology could now be applied for a smaller area in Ireland producing a more detailed picture of subsurface processes. Further work could focus on the development of GeoM alongside the SF, instead of a separate entity.

Other Questions

18. *Does the methodology offer additional benefits which were previously unaccounted for?*

Answer :

The development of a SF as an interactive and pre-interpreted geological map.

19. *Has the methodology opened up new opportunities for further development, exploration or valorisation?*

Answer :

WP5 - T5.3 Learning from the case studies

Important information

The questionnaire will be based from each case study's lessons learnt report. Please read the selected report thoroughly before completing this questionnaire. The questionnaire should take approximately 2 hours to complete. The questions which are labelled with an (*) are required fields.

Due to the variation in methodological approaches and lessons learnt reports, some questions might be more suited to one case study than others, and some questions may not apply to certain case studies. If a question does not apply to a case study, please explain why.

***Name:**	**Vit Hladik / Ales Havlin**
***Organisation:**	**Czech Geological Survey**
***Date:**	**14/09/2021**
***Case study evaluating *(please highlight)*:**	Roer-to-Rhine | Pannonian Basin | Ireland | Molasse Basin

Structural Framework

Do you agree with the following statements? :

5. * *In this case study, the structural framework has been successful in making the geology of the area more understandable.*

☐ Strongly disagree | ☐ Somewhat disagree | ☐ Somewhat agree | ☒ Strongly agree

* Please explain the reason for your choice in a few sentences. Use of the structural framework allows for "simplification of the geological picture" of the country compared with the standard geological map, which can support the understanding of basic geological structure, especially for non-specialists. The level of detail adapted to various zoom levels seems to be very useful in this respect.

6. * *In this case study, the structural framework has been successful in providing a coherent geological context for subsurface applications.*

☐ Strongly disagree | ☐ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences.

This is not directly discussed in the study but, in principle, the geological context is provided, at least on national and regional scales.

7. **In this case study, the structural framework can aid in identifying and/or resolving subsurface management issues? E.g direct/indirect conflicts of use; zones of influence; areas of potential reuse and synergies; potential hazards etc… (please discuss multiple options if necessary)*.

☐ Strongly disagree | ☒ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences.

Similarly to the authors, we think that the national scale of the structural framework is too small to enable its use for site-specific subsurface mgmt. issues relevant for Ireland. The approach can, however, prove useful if applied at a more detailed scale.

8. ** In this case study, what issues/barriers do you identify in applying the structural framework methodology? e.g large scale, large amounts of geological data, time consuming etc…*

* Please explain your answer in a few sentences.

This is rather a question for the authors. They identified the differences in onshore vs. offshore input data and information, the impossibility to display folding and the need of subjective decision-making in reduction of available information to fit the structural framework as the main issues, and we do not have any reason to question these findings.

20. * *In this case study, have you identified any fundamental issues / show stoppers / limitations regarding the application of the structural framework?*

* Please explain your answer in a few sentences. The main limitation is probably the 2D (map) character of the framework. For its practical utilisation, e.g. for the subsurface management purposes, a 3D view (model) is needed in most cases.

21. *Do you have any further recommendations / suggestions which would benefit the application of the Structural Framework in this case study?*

Please explain the reason for your answer in a few sentences. No.

Geomanifestations

Do you agree with the following statements :

22. * *In this case study, geomanifestations have been successful as specific expressions that identify ongoing or past geological processes:*

☐ Strongly disagree | ☐ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences.

There are good examples of geomanifestations provided; the description of their relationships to geological processes is, unfortunately, too brief.

23. * *In this case study, geomanifestations have been successful in improving/completing the geological understanding:*

☐ Strongly disagree | ☒ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences.

The study rather tried to interpret geomanifestations on the basis of existing geological knowledge.

24. *In this case study, was the incorporation of Geomanifestations successful in helping identifying specific/potential management issues in the subsurface? E.g direct/indirect conflicts of use; zones of influence; areas of potential reuse and synergies; potential hazards etc… (please discuss multiple options if necessary).*

* Please explain your answer in a few sentences. No, the study does not deal with this.

25. * *In this case study, what are the issues/barriers concerning the application of Geomanifestations? e.g large scale, large amounts of geological data, time consuming etc…*

* Please explain your answer in a few sentences. Some geomanifestations are connected to geological features not represented in structural framework (karst phenomena), which is also connected with scale issues.

26. * *In this case study, have you identified any fundamental issues / show stoppers regarding the application of the Geomanifestations?*

*Please explain your answer in a few sentences.

The main issue is apparently the level of detail used for the structural framework that should correspond to the nature of geomanifestations, so that they can be linked to features shown in the framework.

27. *Do you have any further recommendations / suggestions which would benefit the application of the Geomanifestations in this case study?*

Please explain the reason for your answer in a few sentences.

No

Structural Framework and Geomanifestations integration

Do you agree with the following statements :

28. * *The structural framework model annotated with geomanifestations enhances our understanding of the subsurface*

☐ Strongly disagree | ☒ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences.

The study rather gives the impression that current knowledge and understanding of the subsurface was used to apply the structural framework and interpret geomanifestations.

29. * *The Structural Framework benefits from the incorporation of Geomanifestations into the model*

☐ Strongly disagree | ☐ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

Please give additional information if necessary.

The study provides some indications of this but without sufficient level of detail.

30. * *The Geomanifestations benefit from the context of the Structural Framework*

☐ Strongly disagree | ☒ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

Please give additional information if necessary.

The study does not provide clear indications of this.

31. **What barriers prevent both methodologies working (efficiently) together?*

* Please explain your answer in a few sentences.

Mainly the scale issues – see point 11.

32. **Overall, has the methodology been applied successfully within the selected area, fulfilling the aims it set out to achieve? Please give a rating out of 10 and offer a brief explication in the box below.*

'The prime aim of GeoConnect³d is the conversion of geological data into subsurface information and critical parameters that can be used for various geo-applications, decision-making and subsurface spatial planning.'

☐	☐	☐	☐	☐	☒	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9	10

*Please explain the reason for your answer in a few sentences.

The study successfully tested applicability of methods and approaches developed in WP3 and WP4 on a pilot study, even though the Ireland case study cannot be considered “smaller-scale”, and obviously required a lot of effort. The issues related to implementation of the structural framework and geomanifestations have mostly been successfully solved.

With respect to the objective of proposing improved methods for decision making for subsurface planning and management, in our opinion the study was only half-way successful because the national-scale structural framework was apparently too coarse for possible subsurface planning applications in the geological conditions of Ireland.

Other Questions

33. *Does the methodology offer additional benefits which were previously unaccounted for?*

Answer :

Not identified.

34. *Has the methodology opened up new opportunities for further development, exploration or valorisation?*

Answer :

Yes, but its possible exploitation should be tested on practical cases where concrete subsurface mgmt. issues were observed / studied.

WP5 - T5.3 Learning from the case studies

Important information

The questionnaire will be based from each case study's lessons learnt report. Please read the selected report thoroughly before completing this questionnaire. The questionnaire should take approximately 2 hours to complete. The questions which are labelled with an (*) are required fields.

Due to the variation in methodological approaches and lessons learnt reports, some questions might be more suited to one case study than others, and some questions may not apply to certain case studies. If a question does not apply to a case study, please explain why.

***Name:**	**Tanja Petrović Pantić**
***Organisation:**	**Geological Survey of Serbia**
***Date:**	**13.09.2021.**
***Case study evaluating *(please highlight)*:**	Roer-to-Rhine | Pannonian Basin | **Ireland** | Molasse Basin

Structural Framework

Do you agree with the following statements? :

9. * *In this case study, the structural framework has been successful in making the geology of the area more understandable.*

☐ Strongly disagree | ☐ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences. Yes, it simplifies presentation of geology, and relations between some contacts are clearly visible. But, it is missing map legend or some pointers on to maps to better present situations explained in the text.

10. * *In this case study, the structural framework has been successful in providing a coherent geological context for subsurface applications.*

☐ Strongly disagree | ☐ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences.

It is providing a geological context, but it is not coherent. As mentioned in the report, the problem was free decision what to include in model and what not, and that the structural framework cannot display folding. Also, to better manage subsurface planning, volume of rocks is important, so it is necessary to present third dimension.

11. **In this case study, the structural framework can aid in identifying and/or resolving subsurface management issues? E.g direct/indirect conflicts of use; zones of influence; areas of potential reuse and synergies; potential hazards etc… (please discuss multiple options if necessary)*.

☐ Strongly disagree | ☒ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences.

In this study, subsurface characterization is not fully achieved by structural framework. The main reason is that is missing 3D volume of rock.

12. * *In this case study, what issues/barriers do you identify in applying the structural framework methodology? e.g large scale, large amounts of geological data, time consuming etc…*

* Please explain your answer in a few sentences.

It looks that main issue is a decision on what to display or leave out of the structural framework. Other problem was constructing of the structural framework in the coast line area. And one more issue was how to display folding.

35. * *In this case study, have you identified any fundamental issues / show stoppers / limitations regarding the application of the structural framework?*

* Please explain your answer in a few sentences.
Limitations are: construction of the structural features of the coast line, there is no possibility to display folding and decision what to display or leave out.

36. *Do you have any further recommendations / suggestions which would benefit the application of the Structural Framework in this case study?*

Please explain the reason for your answer in a few sentences.

Geomanifestations

Do you agree with the following statements :

37. * *In this case study, geomanifestations have been successful as specific expressions that identify ongoing or past geological processes:*

☐ Strongly disagree | ☐ Somewhat disagree | ☐ Somewhat agree | ☒ Strongly agree

* Please explain the reason for your choice in a few sentences.

All listed geomanifestations (mineral occurrence, karst features, warm springs, earthquake) are a reflection of geological processes.

38. * *In this case study, geomanifestations have been successful in improving/completing the geological understanding:*

☐ Strongly disagree | ☐ Somewhat disagree | ☐ Somewhat agree | ☒ Strongly agree

* Please explain the reason for your choice in a few sentences.

I completely agree with this statement, geomanifestations can fully enable a better understanding of geological processes.

39. *In this case study, was the incorporation of Geomanifestations successful in helping identifying specific/potential management issues in the subsurface? E.g direct/indirect conflicts of use; zones of influence; areas of potential reuse and synergies; potential hazards etc… (please discuss multiple options if necessary).*

* Please explain your answer in a few sentences. Geomanifestations are helping to identify specific management issues, but it is necessary to include more factors for better management in the subsurface. As authors have mentioned, for subsurface planning it is necessary to know 3D volume.

40. * *In this case study, what are the issues/barriers concerning the application of Geomanifestations? e.g large scale, large amounts of geological data, time consuming etc…*

* Please explain your answer in a few sentences. The issues are scale and displaying geological feature, which are important for geomanifestations.

41. * *In this case study, have you identified any fundamental issues / show stoppers regarding the application of the Geomanifestations?*

*Please explain your answer in a few sentences.

42. *Do you have any further recommendations / suggestions which would benefit the application of the Geomanifestations in this case study?*

Please explain the reason for your answer in a few sentences.

It should perceive geomanifestations in the area and create structural framework with all important features, which could have possible connection with geomanifestations.

Structural Framework and Geomanifestations integration

Do you agree with the following statements :

43. * *The structural framework model annotated with geomanifestations enhances our understanding of the subsurface*

☐ Strongly disagree | ☐ Somewhat disagree | ☐ Somewhat agree | ☒ Strongly agree

* Please explain the reason for your choice in a few sentences. Connections between geomanifestations and structural framework are improving our geological understanding of research area.

44. * *The Structural Framework benefits from the incorporation of Geomanifestations into the model*

☐ Strongly disagree | ☐ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

Please give additional information if necessary. Relationship between geomanifestations and structural framework are certainly improving our geological understanding of research area.

45. * *The Geomanifestations benefit from the context of the Structural Framework*

☐ Strongly disagree | ☐ Somewhat disagree | ☐ Somewhat agree | ☒ Strongly agree

Please give additional information if necessary.

The structural framework can help to better understand appearance of geomanifestations in the research area and to indicate if they are related to faults or not.

46. **What barriers prevent both methodologies working (efficiently) together?*

* Please explain your answer in a few sentences.

The bias of display of structural framework could make difficult to understand geomanifestations in a certain area, and to make it difficult for planning and subsurface management.

47. **Overall, has the methodology been applied successfully within the selected area, fulfilling the aims it set out to achieve? Please give a rating out of 10 and offer a brief explication in the box below.*

'The prime aim of GeoConnect³d is the conversion of geological data into subsurface information and critical parameters that can be used for various geo-applications, decision-making and subsurface spatial planning.'

☐	☐	☐	☐	☐	☐	☐	☒	☐	☐
1	2	3	4	5	6	7	8	9	10

*Please explain the reason for your answer in a few sentences.

The methodology gives good results despite the obvious limitations, which the authors are aware of. The methodology can be used for decision-making and subsurface spatial planning.

Other Questions

48. *Does the methodology offer additional benefits which were previously unaccounted for?*

Answer :

49. *Has the methodology opened up new opportunities for further development, exploration or valorisation?*

Answer :

It is possible to improve methodology and overcome the stated problems (about bias of displaying features, displaying of the important features, 3D volume presentation).

WP5 - T5.3 Learning from the case studies

Important information

The questionnaire will be based from each case study's lessons learnt report. Please read the selected report thoroughly before completing this questionnaire. The questionnaire should take approximately 2 hours to complete. The questions which are labelled with an (*) are required fields.

Due to the variation in methodological approaches and lessons learnt reports, some questions might be more suited to one case study than others, and some questions may not apply to certain case studies. If a question does not apply to a case study, please explain why.

***Name:**	**Nina Rman**
***Organisation:**	**GeoZS**
***Date:**	**14.9.2021**
***Case study evaluating *(please highlight)*:**	Roer-to-Rhine | Pannonian Basin | **Ireland** | Molasse Basin

Structural Framework

Do you agree with the following statements? :

13. * *In this case study, the structural framework has been successful in making the geology of the area more understandable.*

☐ Strongly disagree | ☐ Somewhat disagree | ☐ Somewhat agree | ☒ Strongly agree

Using it, they were able to neglect the young quaternary deposits and show the continuation of the basement units over the island and overseas successfully. So you do not get lost in information from a typical, too colourful (surface) geological map, but can show the main units of evolution of the territory.

14. * *In this case study, the structural framework has been successful in providing a coherent geological context for subsurface applications.*

☐ Strongly disagree | ☐ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences.

They successfully applied 3 scales, I could not read out if they manage to show also offschore geology as they wanted. They explain main limitations are that folding cannot be shown and 3D is not yet applied in this phase.

15. **In this case study, the structural framework can aid in identifying and/or resolving subsurface management issues? E.g direct/indirect conflicts of use; zones of influence; areas of potential reuse and synergies; potential hazards etc… (please discuss multiple options if necessary)*.

☐ Strongly disagree | ☐ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences.

This was not the biggest aim of the work, as they had to solve many SF issues to do it properly. Explanation of geomanifestation in the report was not such as to imply what are the subsurface issues and where and what to do with it as a solution. I did not find an opinion on this, really.

16. * *In this case study, what issues/barriers do you identify in applying the structural framework methodology? e.g large scale, large amounts of geological data, time consuming etc…*

* Please explain your answer in a few sentences.

Lack of data on geomanifestations

Difficulties to jointly interpret SF when combining on- and off-shore data

SF cannot display folds

Some subjective view /interpretation of SF can cause a bias

The scale is not yet useful for direct applications

50. * *In this case study, have you identified any fundamental issues / show stoppers / limitations regarding the application of the structural framework?*

* Please explain your answer in a few sentences. Nothing that cannot be overcome by time and money

51. *Do you have any further recommendations / suggestions which would benefit the application of the Structural Framework in this case study?*

Please explain the reason for your answer in a few sentences. Clearly explain to which goal SF is planned to help to fulfil Work is nice and should be continues Eventually go to 3D

Geomanifestations

Do you agree with the following statements :

52. * *In this case study, geomanifestations have been successful as specific expressions that identify ongoing or past geological processes:*

☐ Strongly disagree | ☒ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences.

They had 4 groups of geomanifestations, but in the report it is not explained what they did with this data and how they related it to SF. They are also not presented in this report. So no intepretation of GF is given.

53. * *In this case study, geomanifestations have been successful in improving/completing the geological understanding:*

☐ Strongly disagree | ☐ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences.

I could not read that from the report. Only few sentences were written, saying mineral resources can be linked to faults and karstification cannot be explained by using SF as other processes (not affecting the basement rocks) make it.

54. *In this case study, was the incorporation of Geomanifestations successful in helping identifying specific/potential management issues in the subsurface? E.g direct/indirect conflicts of use; zones of influence; areas of potential reuse and synergies; potential hazards etc… (please discuss multiple options if necessary).*

* Please explain your answer in a few sentences. Not clear from the report.

55. * *In this case study, what are the issues/barriers concerning the application of Geomanifestations? e.g large scale, large amounts of geological data, time consuming etc…*

* Please explain your answer in a few sentences. Scale should be adjusted when applying GM. Only 3D would be useful for adopting GM.

56. * *In this case study, have you identified any fundamental issues / show stoppers regarding the application of the Geomanifestations?*

*Please explain your answer in a few sentences.

They did not really talk much about that, so I do not have an opinion.

57. *Do you have any further recommendations / suggestions which would benefit the application of the Geomanifestations in this case study?*

Please explain the reason for your answer in a few sentences.

I think that joint intepretation of SF and GM should be done and clearly explain what can be linked and what and why not. This part was not properly presented.

Structural Framework and Geomanifestations integration

Do you agree with the following statements :

58. * *The structural framework model annotated with geomanifestations enhances our understanding of the subsurface*

☐ Strongly disagree | ☐ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences. Yes, if you have proper scale and sufficient data.

59. * *The Structural Framework benefits from the incorporation of Geomanifestations into the model*

☐ Strongly disagree | ☐ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

Please give additional information if necessary. In general yes, but how is not cleary evident/explained in the report.

60. * *The Geomanifestations benefit from the context of the Structural Framework*

☐ Strongly disagree | ☐ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

Please give additional information if necessary.

In general yes, but how is not cleary evident/explained in the report.

61. **What barriers prevent both methodologies working (efficiently) together?*

* Please explain your answer in a few sentences.

Time planning.

It should be an iterative process. Now, it seems an both approaches were in the first phase, preparing the data and the first interpretation, and as it is a new concept, it would need more time on interpretation.

62. **Overall, has the methodology been applied successfully within the selected area, fulfilling the aims it set out to achieve? Please give a rating out of 10 and offer a brief explication in the box below.*

'The prime aim of GeoConnect³d is the conversion of geological data into subsurface information and critical parameters that can be used for various geo-applications, decision-making and subsurface spatial planning.'

☐	☐	☐	☐	☐	☐	☒	☐	☐	☐
1	2	3	4	5	6	7	8	9	10

*Please explain the reason for your answer in a few sentences.

Both approaches were applied, but SF is properly described, GM poorly. Also, joint intepretation can be upgraded. Not much was discussed how to use gained new information for actual subsurface management.

Other Questions

63. *Does the methodology offer additional benefits which were previously unaccounted for?*

Answer :

Not mentironed.

64. *Has the methodology opened up new opportunities for further development, exploration or valorisation?*

Answer :

Yes, it looks very promissing and more work should now be done on interpetation of joined SF and GM datasets to transfer it to user perspective.

WP5 - T5.3 Learning from the case studies

Important information

The questionnaire will be based from each case study's lessons learnt report. Please read the selected report thoroughly before completing this questionnaire. The questionnaire should take approximately 2 hours to complete. The questions which are labelled with an (*) are required fields.

Due to the variation in methodological approaches and lessons learnt reports, some questions might be more suited to one case study than others, and some questions may not apply to certain case studies. If a question does not apply to a case study, please explain why.

***Name:**	**Monika Konieczyńska, Joanna Fajfer**
***Organisation:**	**PIG-PIB**
***Date:**	**15.09.2021**
***Case study evaluating *(please highlight)*:**	Roer-to-Rhine | Pannonian Basin | **Ireland** | Molasse Basin

Structural Framework

Do you agree with the following statements? :

17. * *In this case study, the structural framework has been successful in making the geology of the area more understandable.*

☐ Strongly disagree | ☐ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences.

It simplified the geology picture with focus on Carboniferous reservoirs rocks, but it has been noticed that this simplification leads to biases which need to be controlled by the aim of SF preparation.

18. * *In this case study, the structural framework has been successful in providing a coherent geological context for subsurface applications.*

☐ Strongly disagree | ☐ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences.

It is stated that in the whole country scale the SF is too coarse to be useful for subsurface management in case of particular projects. But the idea of SF and the methodology of its building can be useful in bigger scales for particular applications.

19. *In this case study, the structural framework can aid in identifying and/or resolving subsurface management issues? E.g direct/indirect conflicts of use; zones of influence; areas of potential reuse and synergies; potential hazards etc… (please discuss multiple options if necessary).*

☐ Strongly disagree | ☒ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences. Not exactly, the planar features of SF seems to be found not sufficient for this kind of use. Applications, conflicts, zones of influence can be located on different depths, which one cannot derive from the SF, which is more map than a 3D model. For these kind of issues the 3D tool is needed.

20. * *In this case study, what issues/barriers do you identify in applying the structural framework methodology? e.g large scale, large amounts of geological data, time consuming etc…*

* Please explain your answer in a few sentences. Differences in interpretation of geological features on and off shore made it difficult to unify apparently continuing features into a single limit. Another practical consideration stated that the structural framework cannot display folding, and in areas where the geology is controlled by folding this weakness left the framework looking unfinished.

65. * *In this case study, have you identified any fundamental issues / show stoppers / limitations regarding the application of the structural framework?*

* Please explain your answer in a few sentences. Yes: – the lack of 3D rock volume presentation – geology simplification that needs to be biased in controlled way to satisfy the aim SF is being done for.

66. *Do you have any further recommendations / suggestions which would benefit the application of the Structural Framework in this case study?*

Please explain the reason for your answer in a few sentences. It is interesting if in the areas where geology is controlled e.g. by folding, the presence of certain geomanifestations could contribute to better understanding of geological structures which might counteract weaknesses of the SF itself.

Geomanifestations

Do you agree with the following statements :

67. * *In this case study, geomanifestations have been successful as specific expressions that identify ongoing or past geological processes:*

☐ Strongly disagree | ☐ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences.

The relation between SF and geomanifestations is not obvious in this case study. SF focuses on carboniferous basin and shelf features and GM related to and controlled by the same factors as structures like Pb-Zn ores can be easily bond to SF. But GMs that are of different origin in time, especially created later, like karst features, do not reflect the SF related geological processes.

68. * *In this case study, geomanifestations have been successful in improving/completing the geological understanding:*

☐ Strongly disagree | ☐ Somewhat disagree | ☐ Somewhat agree | ☒ Strongly agree

* Please explain the reason for your choice in a few sentences.

Geomanifestations, as they appear, they always add to understanding geology of the area, if not understanding, at least improving the recognition. The same in this case.

69. **In this case study, was the incorporation of Geomanifestations successful in helping identifying specific/potential management issues in the subsurface? E.g direct/indirect conflicts of use; zones of influence; areas of potential reuse and synergies; potential hazards etc… (please discuss multiple options if necessary).*

* Please explain your answer in a few sentences.

They definitely helped to identify critical raw material potential of the presented units and following, the possible conflicts in case one wanted to use the ore-rich zone for different purposes. Warm springs could give the idea on geothermal applications, but it is not clear if they are associated with the presented main features. Detailed map study is required.

70. * *In this case study, what are the issues/barriers concerning the application of Geomanifestations? e.g large scale, large amounts of geological data, time consuming etc…*

* Please explain your answer in a few sentences.

The structural framework focuses on the basin and shelf features of the Carboniferous and effectively displays the major faults that controlled basin formation, but many later faults and structures do not appear. This feature of the framework means that some GM related in time to basin formation, such as Pb-Zn, can be observed, while other like e.g. karst features that may be controlled by later structures do not display a relationship to the SF. Both SF and GM to be chosen need to be defined with the careful awareness of an aim that the whole thing is being done. The bias in SF mentioned in ch. 3.2 must be taken into account in GM choice and relation search.

71. * *In this case study, have you identified any fundamental issues / show stoppers regarding the application of the Geomanifestations?*

*Please explain your answer in a few sentences.

Like the SF, GMs have to be chosen with the careful awareness of an aim that the whole thing is being done and in the right scale resolution for a particular aim/subsurface application.

72. *Do you have any further recommendations / suggestions which would benefit the application of the Geomanifestations in this case study?*

Please explain the reason for your answer in a few sentences.

In our opinion authors are aware of problems and limitations of the GMs set they have chosen. Maybe some benefits can be achieved if they incorporate into the system not only the most abundant/complete datasets, but also features recognized only locally, known e.g. from publications, not necessarily already collected in country-wide databases.

Structural Framework and Geomanifestations integration

Do you agree with the following statements :

73. * *The structural framework model annotated with geomanifestations enhances our understanding of the subsurface*

☐ Strongly disagree | ☐ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

* Please explain the reason for your choice in a few sentences. Till some extend, only if GMs are related to SF features. In cases they are not, they only indicated that something more than features of SF may play a role in subsurface use management.

74. * *The Structural Framework benefits from the incorporation of Geomanifestations into the model*

☐ Strongly disagree | ☒ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

Please give additional information if necessary. Yes, when the relationship between SF and GM is proven and well defined.

75. * *The Geomanifestations benefit from the context of the Structural Framework*

☐ Strongly disagree | ☒ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

Please give additional information if necessary. Not really, if they are connected with different processes and time of origin than SF features

76. **What barriers prevent both methodologies working (efficiently) together?*

* Please explain your answer in a few sentences. It looks that it is not enough put them together to make the whole view more understandable, some expert interpretation is needed in many cases, both in the phase of GM selection and later, when the whole tool is being used.

77. **Overall, has the methodology been applied successfully within the selected area, fulfilling the aims it set out to achieve? Please give a rating out of 10 and offer a brief explication in the box below.*

'The prime aim of GeoConnect³d is the conversion of geological data into subsurface information and critical parameters that can be used for various geo-applications, decision-making and subsurface spatial planning.'

☐ ☐ ☐ ☐ ☐ ☐ ☒ ☐ ☐ ☐

*Please explain the reason for your answer in a few sentences.

The case study showed that on the country scale the SF allows for presentation of main geological features - structures and tectonics which may be relevant for subsurface applications. This can give a general view, but for particular cases there is a need for more detailed resolution to enable decision making based on the SF only. Also connections between SF and GMs are not necessarily straightforward and inclusion of a GM may or may not add on to the whole view. GM need to be chosen with some relation to a particular case - planned activity, and need to be related to the part of subsurface to be directly or indirectly influenced by this activity. If there is no connection/possible influence between GM and subsurface activity, the knowledge of its presence do not add much to the whole view (e.g. karst features in strata overlying a potential reservoir to be used).

Other Questions

78. *Does the methodology offer additional benefits which were previously unaccounted for?*

Answer :

Yes, it's a good exercise. It's not that easy to decide which features are really important, in traditional approach geologists tend rather to multiply details than to generalize.

79. *Has the methodology opened up new opportunities for further development, exploration or valorisation?*

Answer :

In our opinion - the case study shows that there is a need for further development of the methodology to make it more efficient in decision making process.

WP5 - T5.3 Learning from the case studies

Important information

The questionnaire will be based from each case study's lessons learnt report. Please read the selected report thoroughly before completing this questionnaire. The questionnaire should take approximately 2 hours to complete. The questions which are labelled with an (*) are required fields.

Due to the variation in methodological approaches and lessons learnt reports, some questions might be more suited to one case study than others, and some questions may not apply to certain case studies. If a question does not apply to a case study, please explain why.

***Name:**	**Johanna Van Daele**
***Organisation:**	**VPO**
***Date:**	**09-09-2021**
***Case study evaluating *(please highlight)*:**	Roer-to-Rhine | Pannonian Basin | Ireland | Molasse Basin

Structural Framework

Do you agree with the following statements? :

21. * *In this case study, the structural framework has been successful in making the geology of the area more understandable.*

☐ Strongly disagree | ☐ Somewhat disagree | ☐ Somewhat agree | ☒ Strongly agree

The Structural Framework of Ireland can be seen as an interpreted geological map, and thus certainly makes the geology more understandable, e.g., by removing the Namurian sedimentary cover or other "noise" features, or by displaying clear distinctions between basin and shelf regions, faulted blocks and conformable or unconformable contacts without the user needing to understand the implications of the lithology descriptions on a traditional geological map.

22. * *In this case study, the structural framework has been successful in providing a coherent geological context for subsurface applications.*

☒ Strongly disagree | ☐ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

A more local SF approach in 3D is recommended to be useful for (site-specific development of) subsurface applications, but other than that, no links between the SF and relevant subsurface applications are mentioned in the report.

23. **In this case study, the structural framework can aid in identifying and/or resolving subsurface management issues? E.g direct/indirect conflicts of use; zones of influence; areas of potential reuse and synergies; potential hazards etc… (please discuss multiple options if necessary)*.

☒ Strongly disagree | ☐ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

A national-scale SF is considered "too coarse a tool for subsurface planning applications". Smaller scale SF's (in 3D) would be required to answer specific questions about subsurface management issues.

24. ** In this case study, what issues/barriers do you identify in applying the structural framework methodology? e.g large scale, large amounts of geological data, time consuming etc…*

The methodology used to construct the SF is quite straightforward and based on detailed, existing geological maps. As mentioned in the report, the major drawback is the bias included by pre-interpreting these geological maps by, e.g., deciding the basin extent based on the major faults, or selecting which faults are included and which are not. Many faults were omitted, especially at level 1 and 2. Another disadvantage of the applied methodology is that all units are by default divided by age and general lithology at a certain reference subcrop level or the surface, as is the case for traditional geological maps, less than by their (potentially overlapping) structural significance (e.g., the SF of the R2R area).

80. * *In this case study, have you identified any fundamental issues / show stoppers / limitations regarding the application of the structural framework?*

Although the omission of a large proportion of faults makes the geology more understandable and visually very strong, it also quite severely hinders the applicability of the SF, both for tackling subsurface management issues, as well as for understanding the processes behind the inventoried Geomanifestations.

81. *Do you have any further recommendations / suggestions which would benefit the application of the Structural Framework in this case study?*

Including the other faults, preferably with an attribute of timing so that the increased understandability of the geology is not lost.

Adding the 3D-model information if possible (e.g., fault traces on multiple reference planes as was done for the R2R SF).

Geomanifestations

Do you agree with the following statements :

82. * *In this case study, geomanifestations have been successful as specific expressions that identify ongoing or past geological processes:*

☐ Strongly disagree | ☒ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

The selected Geomanifestation types (mineral occurrences, karst features, warm springs and earthquake loci) indeed always refer to an ongoing or past geological process. However, the particularities of the Irish Geomanifestation origins and processes are not highlighted in the report. Rather, the focus is put on their general usability for subsurface management (e.g., prospectivity, groundwater management).

83. * *In this case study, geomanifestations have been successful in improving/completing the geological understanding:*

☐ Strongly disagree | ☒ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

No added value of the Geomanifestations database to the geological understanding is mentioned except for the temporal relation between Pb-Zn mineralization and basin formation. The rationale of selecting the respective Geomanifestation types is well explained, but it cannot be deduced from the report if the case study was successful in finding answers on these research questions (e.g., correlation earthquakes – faults – depth).

84. *In this case study, was the incorporation of Geomanifestations successful in helping identifying specific/potential management issues in the subsurface? E.g direct/indirect conflicts of use; zones of influence; areas of potential reuse and synergies; potential hazards etc… (please discuss multiple options if necessary).*

No added value of the Geomanifestations database to subsurface management issues is mentioned. The rationale of selecting the respective Geomanifestation types is well explained, but it cannot be deduced from the report if useful information was obtained for these topics (e.g., groundwater management).

85. * *In this case study, what are the issues/barriers concerning the application of Geomanifestations? e.g large scale, large amounts of geological data, time consuming etc…*

These are difficult to identify, as very limited information is given about the Geomanifestation applications. As brought forward by the authors, the bias in the SF may inhibit useful interpretations of the Geomanifestations. “For a SF to offer insight into a GM dataset, it needs to incorporate all features that are, or may be, relevant to a specific Geomanifestation type and at an appropriate scale.”

I think much more potential remains to be extracted from the constructed Geomanifestation database (especially if linked to an elaborated SF), both regarding aspects of fundamental geological knowledge as of subsurface management.

86. * *In this case study, have you identified any fundamental issues / show stoppers regarding the application of the Geomanifestations?*

No, but this is difficult to assess as no information is given on how the databases of Geological Service of Ireland and the Irish National Seismic Network were constructed, what definitions were applied to identify something as a 'Geomanifestation', or what the outcome of the inventory is.

87. *Do you have any further recommendations / suggestions which would benefit the application of the Geomanifestations in this case study?*

Including a more complete fault set in the SF would be beneficial for the applicability of the Geomanifestation database. If not done yet, adding 3D information, i.e. depth, as an attribute to the Geomanifestations also might be useful.

Structural Framework and Geomanifestations integration

Do you agree with the following statements :

88. * *The structural framework model annotated with geomanifestations enhances our understanding of the subsurface*

☐ Strongly disagree | ☐ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

The SF allows an easier understanding of the subsurface, especially for people with a less strong geology background or not familiar with the regional geology. It also serves as a good starting point to explain the geological processes behind certain Geomanifestations (e.g., mineralization occurrence), although it is not clear from the report how successful the current SF and GM databases are in this.

89. * *The Structural Framework benefits from the incorporation of Geomanifestations into the model*

☐ Strongly disagree | ☒ Somewhat disagree | ☐ Somewhat agree | ☐ Strongly agree

The Irish SF was constructed independently of the Geomanifestation occurrences, although it is highlighted that the decisions associated to the construction of the SF are or can be related to which Geomanifestations are envisaged to be explained by or tied to the SF.

90. * *The Geomanifestations benefit from the context of the Structural Framework*

☐ Strongly disagree | ☒ Somewhat disagree | ☒ Somewhat agree | ☐ Strongly agree

Part of the Geomanifestations (e.g., the Pb-Zn mineralizations) can be understood more thoroughly with the context of the SF, but that is very dependent on which faults were selected to be included. Not all potential has thus been fully exploited so far.

91. **What barriers prevent both methodologies working (efficiently) together?*

As mentioned before, the interpretation/selection bias associated to the construction of the SF is the main barrier to let both databases fully communicate with each other.

92. **Overall, has the methodology been applied successfully within the selected area, fulfilling the aims it set out to achieve? Please give a rating out of 10 and offer a brief explication in the box below.*

'The prime aim of GeoConnect³d is the conversion of geological data into subsurface information and critical parameters that can be used for various geo-applications, decision-making and subsurface spatial planning.'

☐	☐	☐	☐	☐	☐	☒	☐	☐	☐
1	2	3	4	5	6	7	8	9	10

Even though the Irish case study successfully translates a traditional map to a more understandable and uniform representation of the geology, the SF under its current form (large scale, incomplete fault set, entirely in 2D) hinders a straightforward application to subsurface management (issues). Also the selected Geomanifestations could be investigated more deeply to obtain a larger added value for the subsurface management topics highlighted in the rationale for choosing the respective Geomanifestation types.

Other Questions

93. *Does the methodology offer additional benefits which were previously unaccounted for?*

The interpretation of a geological map towards a Structural Framework provides a very powerful visualization tool of a more understandable subsurface. It can be of great help to bring across messages to people with a limited geological background. The methodology of the SF is relatively well-structured but, as it largely concerns an interpretation of the researchers, should be documented very carefully to ensure (broad) reproducibility and avoid misinterpretations.

94. *Has the methodology opened up new opportunities for further development, exploration or valorisation?*

Answer : /