IP SDI S2025

Work & Place: Comparing gender differences in working people between urban and rural areas in Austria

Authors: Anne Kahles & Lea Effertz
Universität Salzburg
09.7.2025

Introduction

This Spatial Data Infrastructure Project (SDI) focuses on the differences in employment between men and women in urban and rural areas in Austria, implemented in an exploratory application, that uses the ArcGIS Dashboard interface. We built an application that shows discrepancies in order to build awareness and to spread information for teenage girls. The goal was to create an application in ArcGIS Dashboard that introduces the topic to the recipients and then allows them to explore different related datasets through dashboard-like representations, with the data being available in a PostgreSQL database that is connected to the Geoportal through ArcGIS Enterprise. The granularity is urban and rural areas in the different Austrian federal states (NUTS-2).

Project purpose, goals and target group

We want to encourage and motivate young women and girls to explore the gender specific issues related to employment to sensitize them for gender specific differences as well as differences related to the degree of urbanisation, inspired by the Digital Navigator project funded by the Austrian Bundeskanzleramt.

The benefits are motivating girls and young women to draw their own conclusions as well as to critically examine and to explore the data provided to make informed decisions in their future employment. Another benefit is aiding data and media literacy and to be sensitized for existing barriers but to also encourage them to lower these, sometimes mental, barriers. As a result, we might inspire young girls and help them reflect on their own beliefs and expectations. Our target groups therefore are teenage girls who may explore our application in a workshop setting, which had to be kept in mind when designing a user experience that appeals to teenage girls as we aimed to prepare the data to be easily understandable.

What we do not want to fully explore are the differences between different professions. Neither do we want to fully explore the entire state of the labour market, rather we want to work on gender-based differences and differences related to the grade of urbanisation.

The project is carried out within the IP SDI services Implementation, which is why the focus is on the development and implementation of a spatial data infrastructure.

Project Management & Presentations

Work Packages & Work Breakdown Structure (WBS)

We used a Work Breakdown structure (WBS) as an overview for all our work-packages and tasks and adapted it as the project evolved (Figure 1). The project was broken down into six work packages.

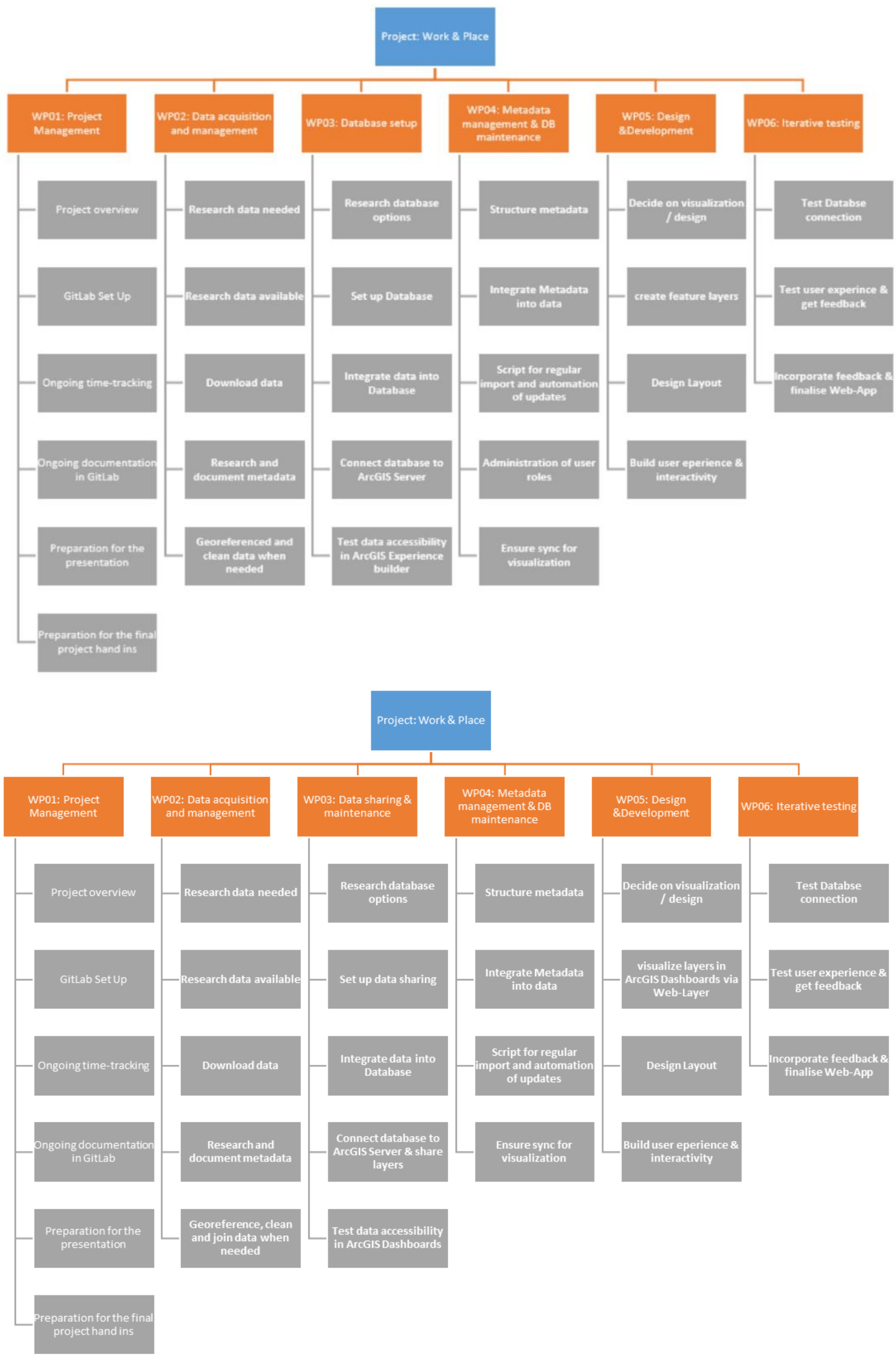


Figure 1: New versus old Work Breakdown Structure as an overview over the work packages and tasks

The main change was the fact that since the Database was provided to us by the course instructors we did not need to create one ourselves, we just needed to make sure that the data is shared properly and accessible to everyone. Other than this change, most of the project management worked seamlessly, with minor adjustments. Another change we made along the way, we decided to not include the automated update of the data. We looked into the possibilities to update the data regularly, but found that since it is not possible to automatically retrieve the data without proprietary access to StatCube, it is not feasible to do within this project. The workflow would have consisted of automatically retrieving the data, performing the clean operations (using an pythons script and openpyxl) to then perform the further data processing towards the dashboard in model builder. This may be something to investigate further for future projects but does not seem to be feasible or useful for the scope of this project.

GitLab

To manage the project and to track our progress we used GitLab. Within the GitLab instance we tracked our tasks and the timeline through using issues, milestones and the corresponding issue board (Figure 2).

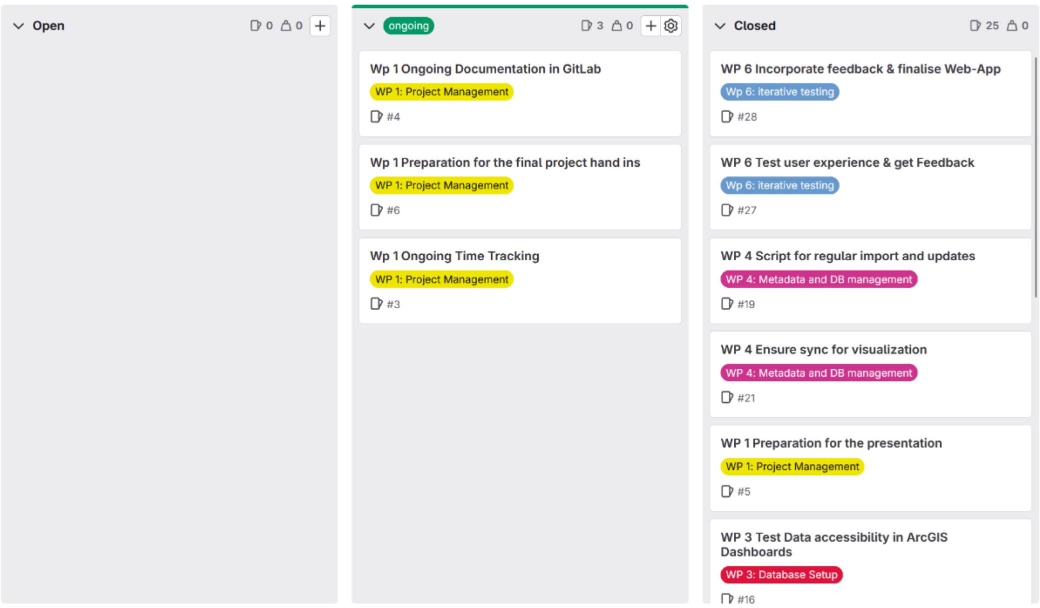


Figure 2: Overview over the Kanban used for managing the issues

We also used due dates to keep our time-plan in mind and used the tasks to document important updates (Figure 3) and the wiki in GitLab to work on our project overview, which was greatly helpful for the final report.

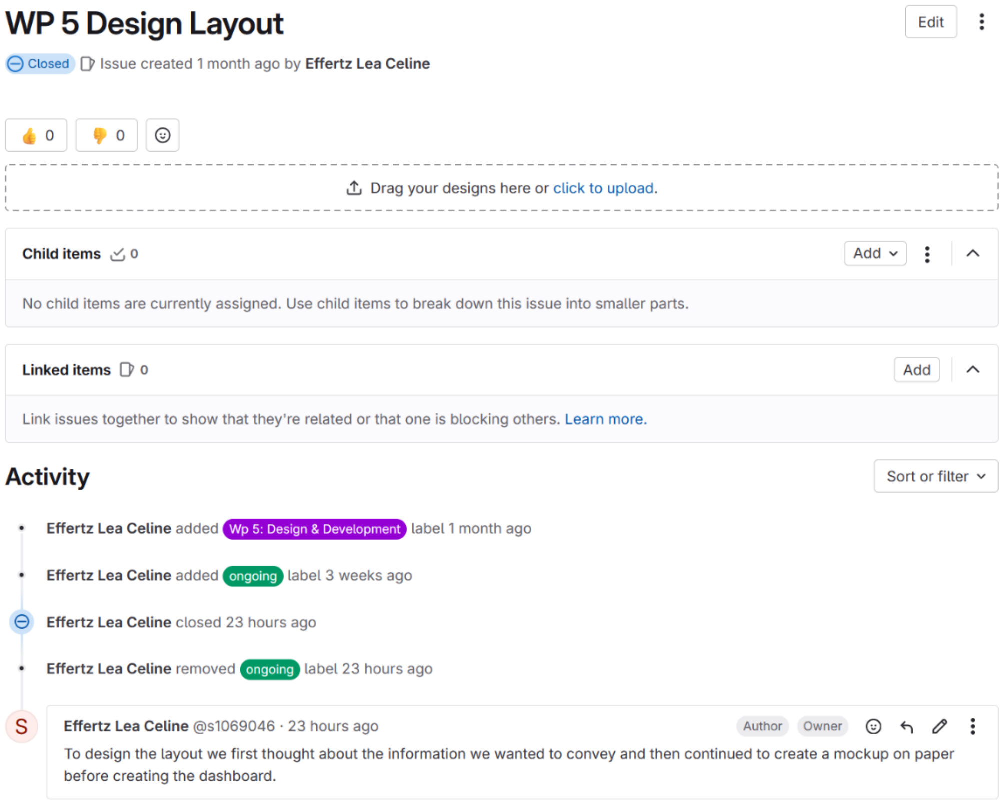


Figure 3: example of recording the progress of issues in GitLab

Gantt chart

We used the Gantt-chart to track our projects progress and to also keep the tasks in mind. We noticed, however that we used the GitLab instance more, as it was much more agile and easier to use.

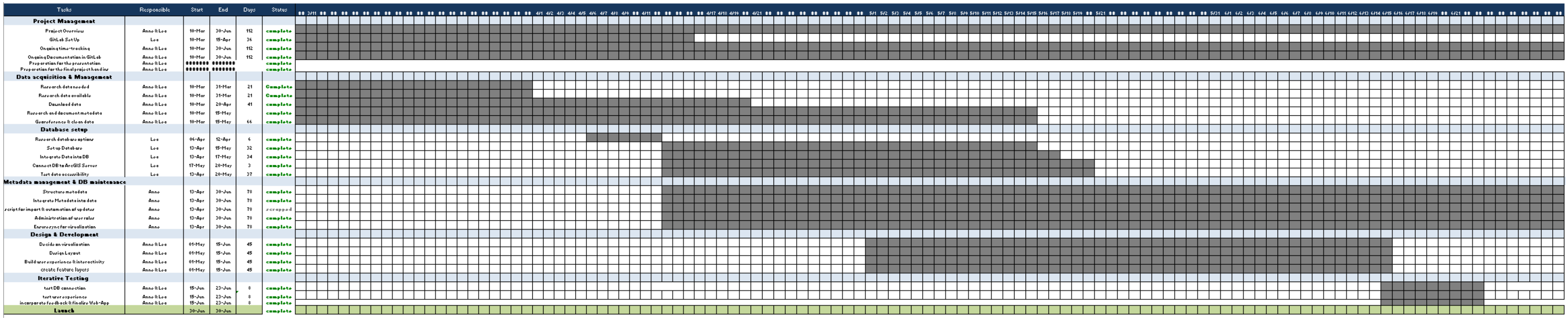


Figure 4: final version of our Gantt-chart, for a full-sized view, the document can be found in the GitLab repository

Milestone plan

As interim goals we set some time-bound milestones to keep an efficient workflow and organise our project. Some deadlines had to be extended cause the processes took longer than initially expected, for example to clean and georeference the data or embedding metadata into the datasets. We dropped the milestone 4.2, because developing a script for automated data updates seemed a bit extensive for our purpose.

Table 1: Overview over the milestones set for the project

	Name	Date Completion
M 1.1	Project overview template filled out	6.04.2025
M 1.2	GitLab Setup	15.4.2025
M 1.3	Final presentation completed	23.6.2025
M 1.4	Final deliverables handed in	30.6.2025
M 2.1	Data Acquired	13.4.2025
M 2.2	Data cleaned & georeferenced	20.4.2025
M 2.3	Metadata Acquired	20.4.2025
M 3.1	Database setup	30.4.2025
M 3.2	Data in Database	30.4.2025
M 4.1	Embed metadata into data	25.4.2025
~~M 4.2~~	~~Developing script for data updates~~	~~25.6.2025~~
M 4.3	Administrate user roles	30.4.2025
M 5.1	Decide on visualisation	11.5.2025
M 5.2	Create Web-App	15.6.2025
M 6.1	get feedback from colleagues	19.6.2025
M 6.2	correct database connection / visualization	23.6.2025
M 6.3	finalize application	23.6.2025

Interim Presentation

Beginning of May we held an interim presentation to update our colleagues about the project status. There we covered an overview over the project management, approach and data we acquired including our data sources as you can see in Figure 5, the SDI methods we wanted to implement and the progress we made so far.

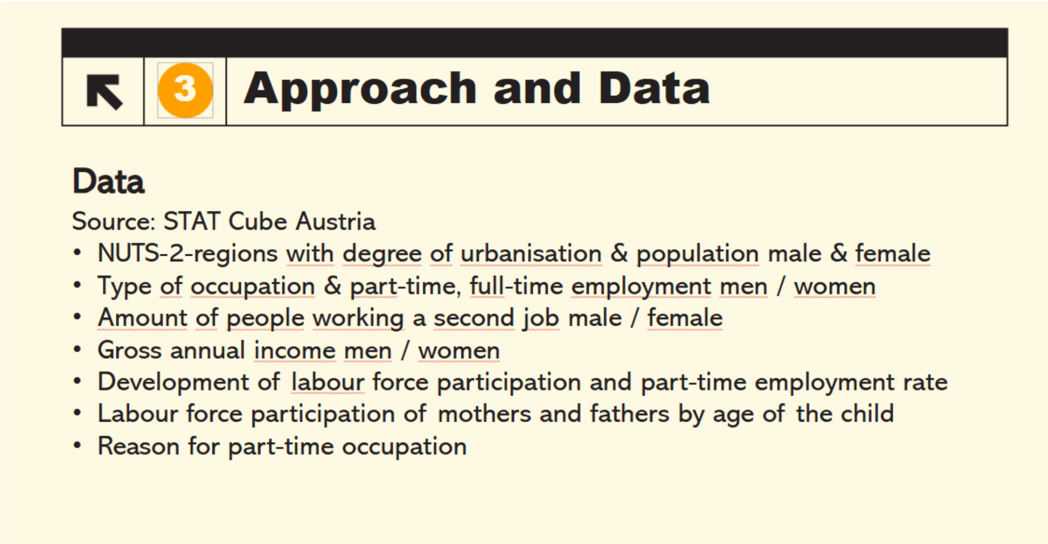


Figure 5: Overview of acquired datasets from the interim presentation

At this point we downloaded all datasets, established a connection to the PostgreSQL-database and were in the process of joining and georeferencing the data, as well as discussing the possible data visualizations in detail. The interim presentation also gave us the opportunity to receive feedback and implement advice from fellow colleagues and the course instructors.

Final presentation

In the final presentation we elaborated on the data processing and technical details as described in the next section. We explained our approach, how we created data layers, shared our ArcGIS-Web-Layers in the Geoportal and integrated them with a Web Map. Part of the presentation was also to show our end product – an interactive Dashboard while we explained our visualizations and the thought behind design decisions. Regarding the SDI architecture, subsequent to the interim presentation, we described the software usage and technical implementations of each step, which you can see in Figure 8.

There were also some problems addressed, which we faced during the process such as connection errors to our database or the geoportal. Again, we received valuable feedback, for example referring to colours and text visualisations, that we used to improve and finalise our Dashboard.

Data

The data we used needed some pre-processing to be used in our designed SDI, the steps to achieve this are detailed below. We used custom off the shelf architectures as well as the architecture recommended to organise our data. The data is on the one hand stored

in a PostGIS enabled database and made accessible as an ArcGIS Feature Service and WFS-Layer.
We decided to store the metadata in our GitLab repository and on Geonetwork, to be accessible easily both for the members of the course and others from outside who might be interested. Generally, we wanted to make sure that the data is both easily usable within our SDI and also further down the line by others who may be interested in working with the data we created, which is why we decided on these methods of publication.

NUTS-2 regions, municipalities, urban rural topology and population data

Data Source

A shapefile with all municipalities of Austria was downloaded from Statistik Austria, containing the municipality ID and name, published in 2025. From the same data provider in the STATatlas we acquired the absolute population data per municipality as of January 2025 as a csv. Another csv-file containing the degree of urbanization per municipality was also downloaded from the STATatlas, published in January 2025. The urbanization degree was represented by values from 1 to 3, depicting densely, moderately and sparsely populated municipalities.

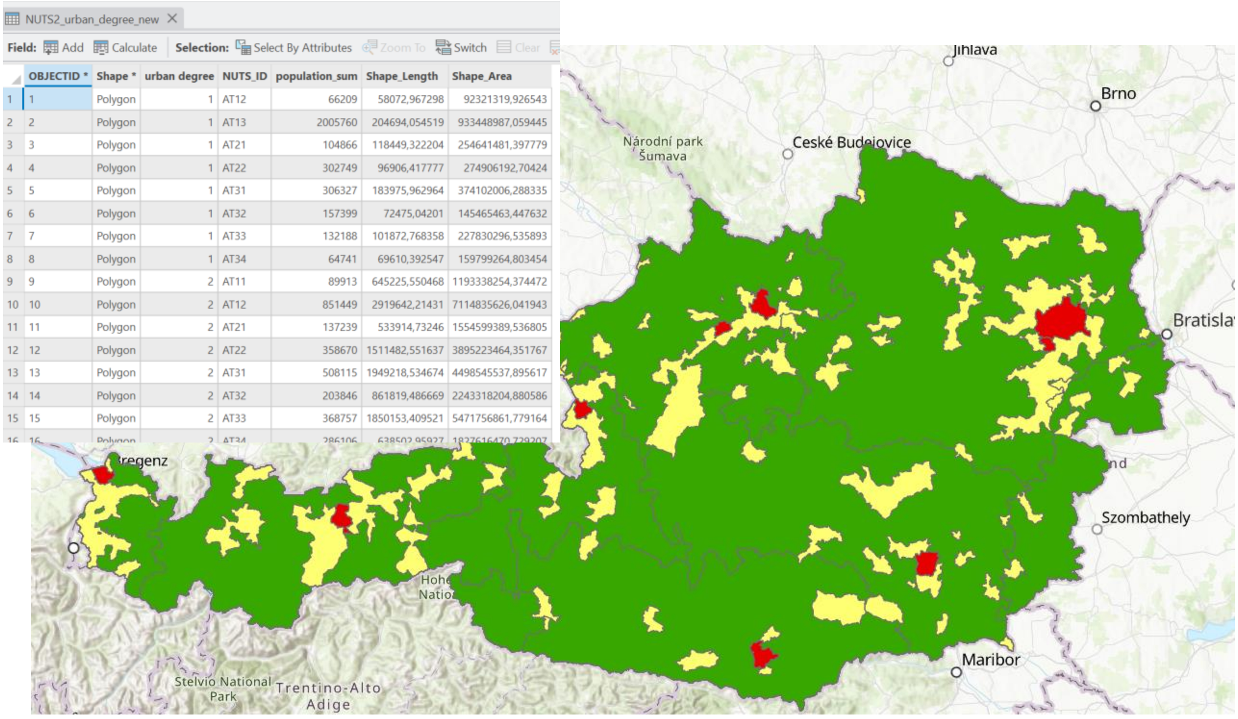
Additionally, we downloaded a NUTS-dataset from the Eurostat Website by the European Commission as a shapefile, containing levels 1, 2 and 3 of the Nomenclature of Territorial Units for Statistics for the whole European Union, valid for 2021.

Data preparation and processing

All the datasets had to be pre-processed in order to guarantee a clean data join and later visualisation. Therefore, the following steps were carried out:

- Projecting municipality shapefile from MGI Austria Lambert to WGS 1984 Web Mercator
- Saving municipality ID as an integer (adding new field with field type long)
- Joining the municipality shapefile with the population table and urban degree table based on the municipality ID
- Defining a definition query in NUTS-shapefile to filter only the austrian regions and only NUTS-2 regions
- Carrying out a spatial join of the municipality shapefile and the altered NUTS-2 region shapefile
- Dissolving the joined shapefile based on their NUTS-2-regions and their urban typology (densely, moderately, sparsely populated), which resulted in a dataset containing polygons based on their urban degree with the respective population count for each NUTS-2 region.

Since the resulting shapefile had some incorrectly assigned municipalities around Vienna and some missing population data, we had to manually correct the pre-dissolved joined shapefile and add the missing population data as well as the right NUTS-2-affiliation and then dissolve it again.


NUTS2_urban_degree_new

	OBJECTID *	Shape *	urban degree	NUTS_ID	population_sum	Shape_Length	Shape_Area
1	1	Polygon	1	AT12	66209	58072,967298	92321319,926543
2	2	Polygon	1	AT13	2005760	204694,054519	933448987,059445
3	3	Polygon	1	AT21	104866	118449,322204	254641481,397779
4	4	Polygon	1	AT22	302749	96906,417777	274906192,70424
5	5	Polygon	1	AT31	306327	183975,962964	374102006,288335
6	6	Polygon	1	AT32	157399	72475,04201	145465463,447632
7	7	Polygon	1	AT33	132188	101872,768358	227830296,535893
8	8	Polygon	1	AT34	64741	69610,392547	159799264,803454
9	9	Polygon	2	AT11	89913	645225,550468	1193338254,374472
10	10	Polygon	2	AT12	851449	2919642,21431	7114835626,041943
11	11	Polygon	2	AT21	137239	533914,73246	1554599389,536805
12	12	Polygon	2	AT22	358670	1511482,551637	3895223464,351767
13	13	Polygon	2	AT31	508115	1949218,534674	4498545537,895617
14	14	Polygon	2	AT32	203846	861819,486669	2243318204,880586
15	15	Polygon	2	AT33	368757	1850153,409521	5471756861,779164

Figure 6: Final Shapefile with dissolved regions, urban degree and population count

Metadata

For the NUTS-shapefile from the European Commission the metadata could be easily downloaded as an XML-File and integrated into ArcGIS Pro. For the joined dataset, we also needed the metadata for the population, urban density and municipality shapefile from Statistik Austria, which was not as easy to find. Therefore, we needed to manually create the Metadata file in ArcGIS Pro with various distributed metadata sources according to ISO 19139 standards and described the data processing in the Lineage section.

Georeferenced Employment data

Data Source

The tabular labour-survey data used for the final employment dataset was sourced through StatCube from Statistik Austria together with the data mentioned previously. It was provided as an excel-file and contained the statistics on working full versus part-time, divided by gender. Spatially the data was divided per NUTS-2-region and within that by degree of urbanisation. The data sourced was from the year 2024 and contained within one data sheet.

Data preparation and processing

The provided data was, however, not yet ready for processing, as it contained a title and multiple merged cells. Which are elements that do not allow for the processing in ArcGIS pro. To allow for the processing of the data (Figure) it was first cleaned by executing the following steps:

- Deleting decorative graphics, the title and legend in the document
- Unmerging all merged cells and adding each cell separately
- Adding the NUTS-2-unit as a separate column
- Translating the province-names from English to German, for clarity in the dashboard
- Multiplying the numbers given by 1000, to make it comparable to the population data.

Austrian Micro census - Labour Force Survey Yearly Data (NQS)
Year, Province (NUTS 2-unit) <9> and Degree of urbanisation by Persons in Thousand, Sex <2> and Extent of employment <2>
Counting: Persons in Thousand

Persons in Thousand			Persons in Thousand			
Sex <2>			female		male	
Extent of employment <2>			Full-time work	Part-time work	Full-time work	Part-time work
Year	Province (NUTS 2-unit) <9>	Degree of urbanisation				
	Burgenland <AT11>	Densely-populated area	-	-	-	-
		Intermediate area	9,8	6,9	15,5	1,4
		Thinly-populated area	25,1	25,8	50,2	6,0
		Not classifiable <0>	-	-	-	-
	Carinthia <AT21>	Densely-populated area	13,8	9,5	20,9	3,3
		Intermediate area	16,8	17,4	33,5	3,4
		Thinly-populated area	36,4	33,3	70,2	7,9
		Not classifiable <0>	-	-	-	-
	Lower Austria <AT12>	Densely-populated area	-	-	-	-
		Intermediate area	106,2	94,8	182,8	30,8
		Thinly-populated area	92,6	106,4	202,9	28,3
		Not classifiable <0>	-	-	-	-
	Upper Austria <AT31>	Densely-populated area	28,5	30,0	50,0	10,0
		Intermediate area	60,6	67,5	133,1	16,1
		Thinly-populated area	70,4	106,2	178,2	24,1
		Not classifiable <0>	-	-	-	-
	Salzburg <AT32>	Densely-populated area	20,7	16,4	33,4	6,4
		Intermediate area	19,4	24,0	41,1	5,2
		Thinly-populated area	29,2	32,2	62,2	6,2
		Not classifiable <0>	-	-	-	-
2024		Densely-populated area	33,1	37,6	63,0	17,0

Year	Province (NUTS 2-unit) <9>	NUTS-2 Code	ID_urbanisation	Degree of urbanisation	female Full-time work	female Part-time work	male Full-time work	male Part-time work
2024	Burgenland	AT11	1	Densely-populated area	-	-	-	-
2024	Burgenland	AT11	2	Intermediate area	9800,0	6900,0	15500,0	1400,0
2024	Burgenland	AT11	3	Thinly-populated area	25100,0	25800,0	50200,0	6000,0
2024	Burgenland	AT11	0	Not classifiable <0>	-	-	-	-
2024	Kärnten	AT21	1	Densely-populated area	13800,0	9500,0	20900,0	3300,0
2024	Kärnten	AT21	2	Intermediate area	16800,0	17400,0	33500,0	3400,0
2024	Kärnten	AT21	3	Thinly-populated area	36400,0	33300,0	70200,0	7900,0
2024	Kärnten	AT21	0	Not classifiable <0>	-	-	-	-
2024	Niederösterreich	AT12	1	Densely-populated area	-	-	-	-
2024	Niederösterreich	AT12	2	Intermediate area	106200,0	94800,0	182800,0	30800,0
2024	Niederösterreich	AT12	3	Thinly-populated area	92600,0	106400,0	202900,0	28300,0
2024	Niederösterreich	AT12	0	Not classifiable <0>	-	-	-	-
2024	Oberösterreich	AT31	1	Densely-populated area	28500,0	30000,0	50000,0	10000,0
2024	Oberösterreich	AT31	2	Intermediate area	60600,0	67500,0	133100,0	16100,0
2024	Oberösterreich	AT31	3	Thinly-populated area	70400,0	106200,0	178200,0	24100,0
2024	Oberösterreich	AT31	0	Not classifiable <0>	-	-	-	-
2024	Salzburg	AT32	1	Densely-populated area	20700,0	16400,0	33400,0	6400,0
2024	Salzburg	AT32	2	Intermediate area	19400,0	24000,0	41100,0	5200,0
2024	Salzburg	AT32	3	Thinly-populated area	29200,0	32200,0	62200,0	6200,0
2024	Salzburg	AT32	0	Not classifiable <0>	-	-	-	-
2024	Steiermark	AT22	1	Densely-populated area	33100,0	37600,0	63000,0	17000,0
2024	Steiermark	AT22	2	Intermediate area	33400,0	45500,0	83900,0	7100,0
2024	Steiermark	AT22	3	Thinly-populated area	64200,0	80300,0	138500,0	15700,0
2024	Steiermark	AT22	0	Not classifiable <0>	-	-	-	-
2024	Tirol	AT33	1	Densely-populated area	16800,0	20200,0	31700,0	8600,0
2024	Tirol	AT33	2	Intermediate area	32400,0	44000,0	73800,0	10200,0
2024	Tirol	AT33	3	Thinly-populated area	36400,0	43600,0	80400,0	8600,0
2024	Tirol	AT33	0	Not classifiable <0>	-	-	-	-
2024	Vorarlberg	AT34	1	Densely-populated area	-	-	-	-
2024	Vorarlberg	AT34	2	Intermediate area	33600,0	44000,0	77100,0	10200,0
2024	Vorarlberg	AT34	3	Thinly-populated area	9300,0	9200,0	21700,0	2500,0
2024	Vorarlberg	AT34	0	Not classifiable <0>	-	-	-	-
2024	Wien	AT13	1	Densely-populated area	253300,0	193900,0	391100,0	94500,0
2024	Wien	AT13	2	Intermediate area	-	-	-	-
2024	Wien	AT13	3	Thinly-populated area	-	-	-	-
2024	Wien	AT13	0	Not classifiable <0>	-	-	-	-
2024	Nicht Klassifizierbar	0	1	Densely-populated area	-	-	-	-
2024	Nicht Klassifizierbar	0	2	Intermediate area	-	-	-	-
2024	Nicht Klassifizierbar	0	3	Thinly-populated area	-	-	-	-
2024	Nicht Klassifizierbar	0	0	Not classifiable <0>	-	-	-	-

Figure 7: Comparison of the Dataset from Statistik Austria before (above) and after (below) pre-processing

Finally, the data could be edited in ArcGIS pro and was further processed. To do so, we had to change the field types of the work-statistics, as the column-type was defined as text. To change the field-type to numeric, we used the “calculate field”- tool in ArcGIS. Afterwards we could join the dataset to the existing one with the population data based on the degree of urbanisation and the NUTS-2-unit. This was done using “Join Features” tool as it allowed us to join the data based on multiple conditions.

Metadata

After successfully joining the data, the metadata was added in ArcGIS pro. The Metadata was created based on the information provided by the publishers of the dataset used. The process of finding the accurate Metadata for the datasets was a challenge, as it was not directly linked to StatCube. We found the according metadata on the metadata portal by looking at the dataset the data-conjunction from StatCube was composed from and then used the information to create the metadata for our dataset according to ISO 19139 standards. We also made sure to document the Lineage of the edits we made and why we made them.

SDI Architecture

The integral part of the project was the creation of an SDI architecture, that works well for the purpose. This meant the data needed to be able to be visualised in our dashboard and also accessible to others within and outside of our organisation. For these two reasons we decided to use several products provided by ESRI as a custom off the shelf solution. Using ArcGIS server in accordance with other ArcGIS services allows for a seamless experience for us as creators and also for the user. We were however limited in some regards by this choice, as an open-source solution may have allowed for some further customisation.

The following diagram (8) shows the architecture we composed, as well as the services we employed to create it. It is composed of three section, the data (containing the database and the raw data), processing (containing all data processing steps as well as the sharing to different services) and representation tier (containing the services and actions needed in order to serve the data to the target audience).

We decided to use the custom off the shelf solutions by ArcGIS for performance reasons, but made sure to make the data available in a standard conforming way through OGC-feature service sharing as well the Metadata being according to the ISO 191139 standard to ensure interoperability for the data to be used elsewhere. Since we documented the steps the Dashbaord can be easily maintained and updated, especially because the data served by Statistik Asutria and Eurstat is served in a standardised format if it is updated.

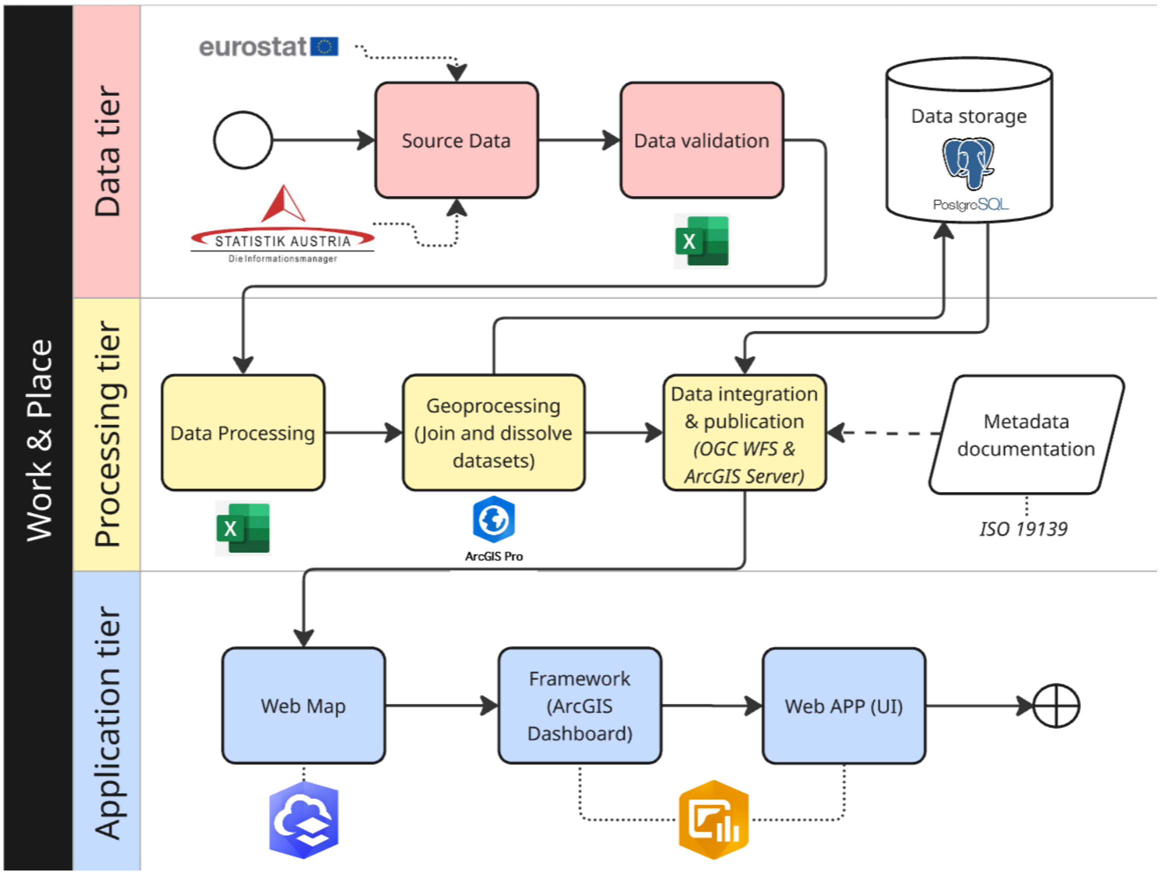


Figure 8: SDI-Architecture and software usage

Data Tier

The data tier consists of the data we first downloaded from Statistik Austria and Eurostat and the validation of said data in Excel. Since the data for the NUTs-2 regions was already in the Coordinate reference System (CRS) WGS 1984 Web Marcator and it is the standard for web-maps, we made sure to either download the data needed in the corresponding format or to transform it to the according CRS. The governmental agencies who published the data can be seen as a reputable source for qualitative data, although we manually also checked the data in Excel to ensure the quality. The data used has a CC-by 4.0 license, allowing us to use the data when crediting the publisher, which we did.

The data was uploaded to a PostGIS enabled PostgreSQL Database later and stored through ArcGIS server. We decided to use this method of storage because the ArcGIS architecture from ESRI works quite seamlessly with other ESRI products and we could share the layers as ArcGIS feature layers, which also allowed us to add the metadata directly in ArcGIS pro and for the data to be available to the target audience and to the other students. Using a PostGIS geodatabase also allows for more performant data retrieval through spatial datatypes, spatial indexing and is also scalable. Another reason for choosing this approach was the integration with ArcGIS online and made the upload through ArcGIS pro quite easy. We also asked for the creation of a group to allow for multi-user editing, so that the edits made by multiple users can be stored simultaneously.

Processing tier

The processing tier consisted of the data pre-processing, the geoprocessing of the data and publishing the data as WFS and ArcGIS Feature Layers. Another part of the processing tier is the documentation of the Metadata, which was added to the data through the ArcGIS pro Meta data editor. The Metadata was constructed according to the ISO 19139 standard specifications based on the metadata provided by the publishers of the source data.

The data was pre-processed in Excel, to make it machine readable. Once this was accomplished, the source data was geoprocessed in ArcGIS pro to achieve the joined and georeferenced datasets we needed for the information we wanted to convey in the dashboard.

Another part is the publishing of the data from the server, to make it accessible. We decided to both publish the data as OGC WFS and also as an ArcGIS feature layer. Although we used the feature layers in our dashboard as it is better integrated in the ESRI-System, we wanted to publish the data as WFS as well, to ensure interoperability.

Representation tier

The representation tier is composed of the web maps that use the feature layers, the ArcGIS Dashboard framework and the published dashboard that serves as a user interface. The web maps were needed to create the different map layers for the dashboard and to style them according to the considerations we made regarding the peer group. We also adapted the pop-ups here to be easier to understand. We integrated the ArcGIS Feature Layers into the map and then added the map-layers to the dashboard to use as a data source. The dashboard can also be filtered to make it easy to use and to not overwhelm the user with data.

The Metadata can both be accessed through the Geonetwork instance setup for the course and directly in the ArcGIS Server instance on the details page of the Dashboard and with the WFS and ArcGIS feature services.

Although we decided to use ArcGIS, the way we shared the data means it can also be connected and used within different services, in the ESRI-Cosmos this could be the experience builder or a Storymap. It could also be used within other Representations or dashboards.

Design & Implementation

General design considerations

For the dashboard we followed general design principles of cartography, such as following a consistent colour scheme, including a legend and using an otherwise minimal colour scheme. We decided to use hues of pink and blue to differentiate the genders, as these are unfortunately still intuitive choices in western society. The colour scheme of the map with the degrees of urbanisation was adapted from the representation of the publication by Statistik Austria.

Because of our target group being teenagers and young adults, we wanted to keep the design as simple and intuitive as possible, while still conveying the relevant information. For this reason, we made sure that the data displayed could be intuitively grasped and understood on first sight, with further information being available through pop-ups, hover effects and the filter for the different NUTS-2 regions.

The data represented in the dashboard includes the average number of people employed in full- and part-time differentiated by gender, as well as the same distribution across degrees of urbanisation.

The map shows the degrees of urbanisation for each NUTS-2-region as an overview and other layers, who each show the distribution of working times and gender for the NUTS-2-regions and respective their degree of urbanisation.

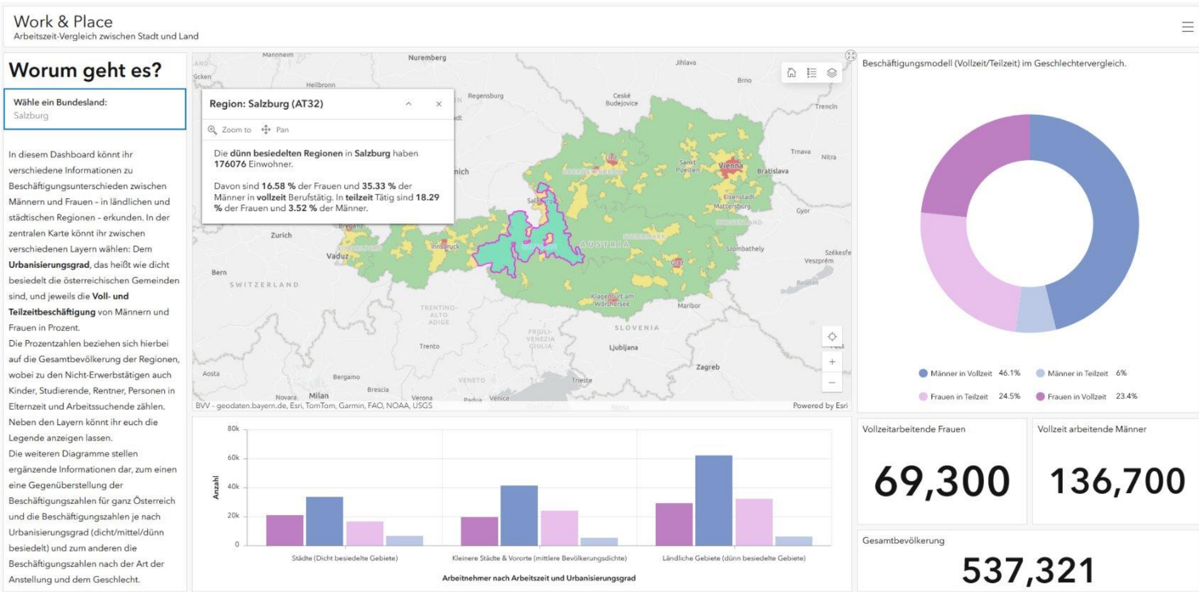


Figure 9: Dashboard before the feedback in class

After the feedback we received in class, we shortened the text in the introduction, coloured the indicators according to our colour scheme and changed the location of the filter to be in the header bar to be more easily accessible. We also included our names as authors and fixed a mistake we made with the metadata. Despite already being quite satisfied with our dashboard, the feedback helped to finally round out the design (Figure 10).

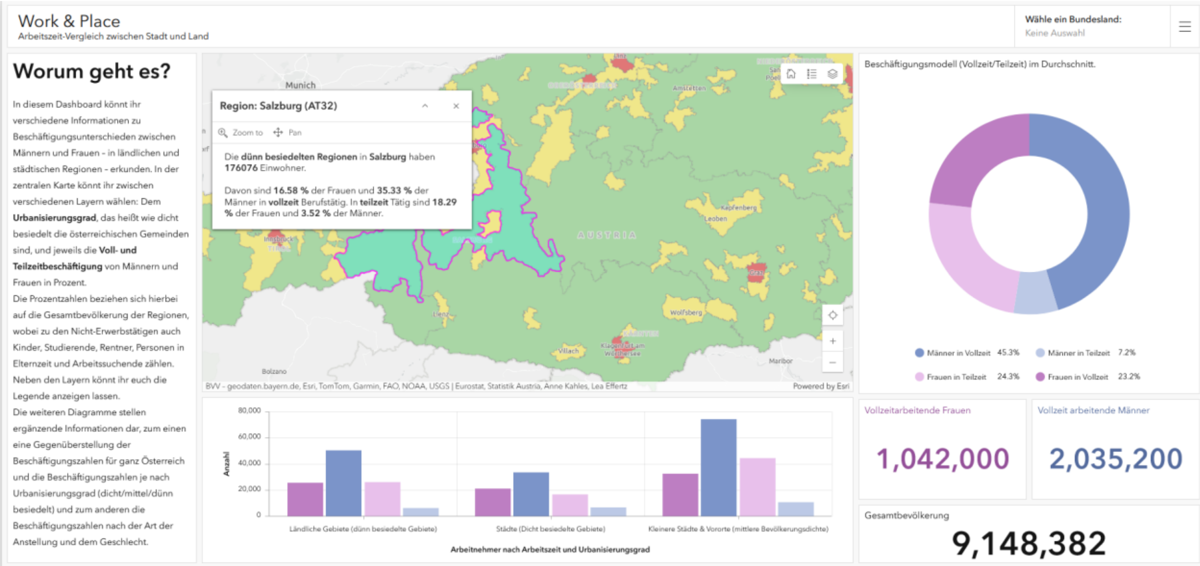


Figure 10: Dashboard after the feedback in class

Adapting to the target group

To convey the information to the target group we made sure to keep the representation and structure of the dashboard quite simple and to also use short descriptions and texts to keep the interest of the recipients initially and to not overwhelm them (Figure 11). The different layers of information with the filtering capabilities and the map-layers, however, allow for exploring the topic on a deeper level, if interest prevails.

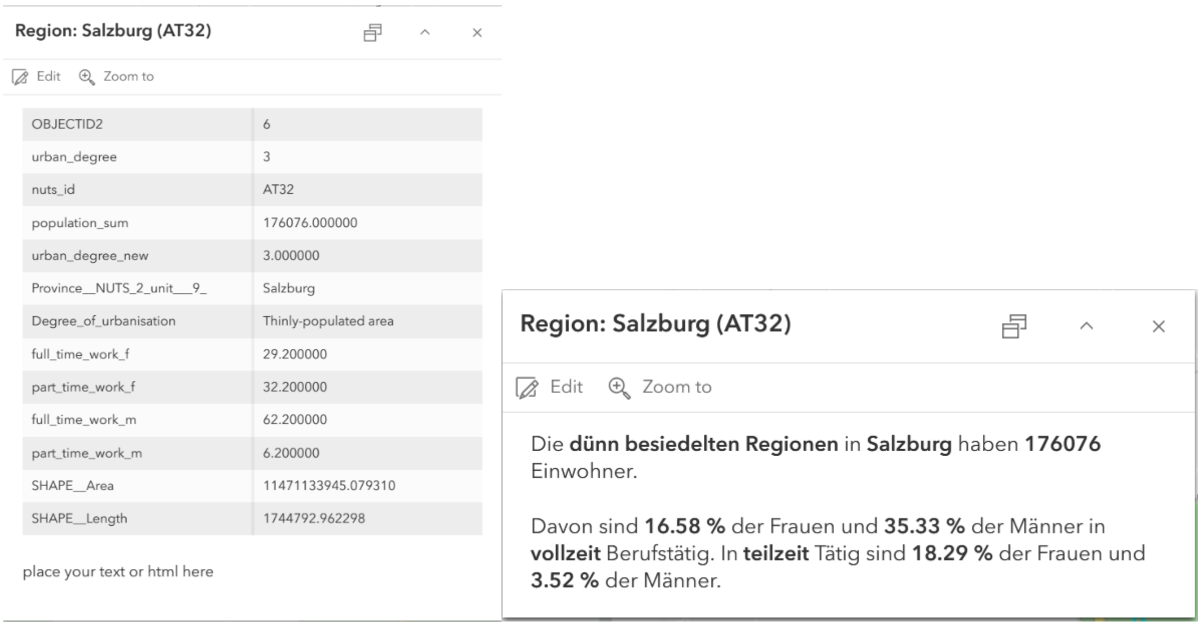


Figure 11: Pop-ups in the map, default versus adapted to fit the target group

We also made sure to adapt the introduction text to the interest of our target group with a short description to guide them through our Dashboard, as it might not be intuitive to some teenagers who are not familiar with geospatial data and its visualization. It also seemed important to us to state that the percentages relate to the total population of the regions, whereby the non-employed also include children, students, pensioners, people on parental leave and job seekers to avoid a distorted perception of those numbers.

Conclusion

The purpose of this project was to develop a Spatial Data Infrastructure (SDI) and an interactive ArcGIS Dashboard to raise awareness of gender-based differences in employment between urban and rural areas in Austria, specifically aimed at teenage girls. We focused on enabling this target group to explore data intuitively and critically, fostering media and data literacy as well as self-reflection. The scope was deliberately limited to gender and urbanisation dimensions at the NUTS-2 level, rather than an exhaustive analysis of the entire labour market.

Technically, the implementation leveraged a PostgreSQL/PostGIS database as the data tier integrating open data, with ArcGIS Enterprise services and a Geoportal forming the processing and representation tiers. The application was designed around standard-compliant, interoperable components, combining ESRI's proprietary tools with open standards (like ISO 19139 metadata and OGC Feature Services) where feasible. Pre-processing the raw data—cleaning, joining, correcting, and georeferencing—required significant effort and was crucial to ensuring a reliable and usable dataset. Tools like Python, ArcGIS Pro, and ModelBuilder supported the workflows, while GitLab provided version control, issue tracking, and documentation throughout.

In terms of design and accessibility, the dashboard and its visualisations were intentionally kept simple and appealing to the intended audience of teenage girls in a workshop setting. Colours, texts, and layouts were iteratively improved based on feedback to ensure clarity, engagement, and accessibility. Furthermore, attention was given to metadata and standards, so the data remains discoverable and reusable beyond the scope of this project.

Key achievements include the creation of a fully functional, user-friendly SDI with an interactive dashboard, the integration of complex, multi-source data into a single coherent system, and the presentations of our work to fellow colleagues. The project also improved our technical skills in SDI architecture, collaborative tools, and communication of complex data to a non-technical audience.

Several lessons were learned: first, the importance of clear metadata and documentation cannot be overstated, especially when integrating diverse datasets. Second, user feedback proved invaluable and should be incorporated as early and as often as possible. Third, while off-the-shelf tools streamline development, they also limit flexibility compared to open-source solutions. Finally, automated data updates—though desirable—were beyond the project's scope, which made us realize we need to align ambitions with available resources.

Looking ahead, potential future directions could include automating data updates once access to proprietary data sources is secured, expanding the dashboard to cover additional variables (such as specific professions or temporal trends), and exploring more customisable or open-source technologies to overcome the limitations encountered. Extending the accessibility of the application—for example through multilingual support or mobile optimisation—would also make it more inclusive and impactful. Our results could furthermore be used in a workshop setting with teenage girls.

In conclusion, the project successfully met its goals by delivering an engaging, technically robust, and meaningful application tailored to its audience, while providing valuable insights and laying a foundation for further development and refinement.

Appendix

Link to our Dashboard:
https://geoportal22s.zgis.at/portal/apps/dashboards/8cd3f1c73fb549a3b489be3bc864d572

Link to our Metadata in Geonetwork:
https://geoserver22s.zgis.at/geonetwork/srv/ger/catalog.search#/metadata/4a486e62-1f61-4f5d-8eab-d98c741f6d16

https://geoserver22s.zgis.at/geonetwork/srv/ger/catalog.search#/metadata/04ac67a5-80bb-4703-b41c-4dbfb8ca8de4

Link to our Group in ArcGIS containing the feature services:
https://geoportal22s.zgis.at/portal/home/group.html?id=cd0316d618f94725ae9ac111ca3c2be2

Link to our GitLab-instance: https://git.sbg.ac.at/s1069046/work-and-place