**VO Selected Topics in Geoinformatics-20231120\_083119-Meeting Recording**

0:11  
So we should to go, should be good to go now again. Good morning,

0:17  
wishing everyone a good start into your Personal Informatics week

0:22  
and I'm glad today to welcome a good colleague and friend of ours. You can already see the name attached. William from the German State University.

0:37  
Yeah, quite a few things in common. Not only current ongoing joint collaboration projects, but also the yeah, the Working in our respective disciplines

0:50  
attack is the Head of Department for Gene Formatics and Cartography identifies quite strongly as a cartographer as well. Again,

1:03  
I'll speak to you in the capital city of Amelia

1:08  
OHH.

1:10  
Beyond that, I think you will mention during and through his talk quite a few things he's currently involved in. And I'm glad to see that today's topic is focusing on accessibility, which is very important analytical growth methodology. Sometimes it's part of network and analytics, sometimes it's also measured

1:40  
outside of network constraints and like it was the domain, we typically have to work with weights or like a weighted network with cost in one or another way. So it's quite a core essential type and category of special analytics and I'm very glad that we will reintroduce to an applied case study on that today. So with that, thank you for offering this talk to us today

2:10  
within the Selected Topics series. And I'd be happy to turn it over to you.

2:17  
Ohh, please mute yourself. And this queen is yours from here. OK.

2:26  
Thank you very much, dear Professor Stobart. Uh, good morning to everyone. Yeah, I hope someone is OK for everyone. Uh yeah. Before starting I have to apologise because I am feeling not very good, uh, during the last days and sometimes maybe I will interrupt myself by coughing, for which I'm very sorry. But anyway,

2:48  
UH UH. As a professor UH struggle already UH introduced UH since September 2023 and acting head of Department of Cartography here in the Universe State University. And before that I was also somehow linked with the university, and mainly after the but as an independent consultant and researcher. And

3:18  
this part of the region not only in Armenia and UH. Today's UH presentation is UH connected to one of these UH project, which I did UH as a consultant of independent researcher

3:35  
UH I called UH it Measuring UH rural Accessibility in the GIS Environment, UH Case Study of Armenia. UH, Yeah and UH. It is UH

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uh mainly connected to the economic part of the country, Uh, like poverty and UH. UH. Infrastructure. UH UH Condition and UH.

4:01  
The project itself UH UH conducted in the framework of the UH BIG Project UH which was founded by the World Bank.

4:13  
The name was Impact of the roads on Poverty and Access. UH and UH at one moment UH UH UH Client Development Office in Armenia. UH need to understand how the impact of the road and the quality of the roads can Somehow we have an impact on poverty And they decided to

4:38  
UH use for these UH GS power and find me UH for this. Yeah and uh, what was the main objective of this UH study? UH And first of all to characterise the physical Rd accessibility in Armenia and second was identifying constraint to market and service access.

5:04  
UH, SO

5:06  
UH and UH Also UM. I would like to introduce UH, the context UH before the study started UH and UH it was UH very simple things like UH Armenia itself was you know very compact size and urban population and primacy but very high share of rural population.

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UH there were a significant UH cross regional UH disparities UH in like in the areas UH and UH. Also in Armenia there are UH very huge migration flows and sees a lot of employment

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and the population is very high dependence on remittances from abroad.

5:57  
And during that uh moment uh some uh administrative uh uh UH change happened. Uh like process of community consolidations. Uh several communities UH

6:12  
merge together and uh uh large uh UH communities emerged UH which also had the UMM uh some affection during the study. And also I would like to umm

6:29  
show this UH map which was UH before the study and UH provided by World Bank. UH this is UH regions of Armenia. You can see 10 regions and this is Lake Sevan and this is capital and here is in poverty rate. You can see for example this one. This is from statistical data and visualisation of statistical data. Please keep in mind this map and we will see UH and compare our UH

7:00  
results with this map. And in the end,

7:03  
but before starting UH to about the methodology tools, I would like to uh have some theoretical part about OHH. Yeah, first of all some evidence is from literature. Before Armenians singular project was happened in Georgia for example and after the project's decision make to upgrade for example 350 kilometres of principal Hwy between the

7:33  
I would like to see and Turkey border to eastern borders of Uh uh Georgia.

7:40  
The road bunker financed uh $5 million of total amount uh 200 uh per free public billion which is uh you can see uh almost 40% of Georgia's GDP and this was this had a very high simulation of the economic simulation because transferring ability of Georgia

8:04  
increased very much and uh this UH estimated long term impact was like uh Georgia GDP UH would be uh from 4.2% higher than before the start of the project and household income against ranged from 2.6 up to 4.4% of increase. And similar project also has Columbia for example.

8:34  
And also some economic growth is it UH, UH, UH has a clear and for example the poverty UH, UH decreased UH about half percent and

8:50  
extreme poverty and UH moderate poverty about 1%. So we can see that such kind of use of GIS and measuring accessibility was very common before we started. And as I said, I would like to also speak a little bit theoretical part in what we know about accessibility. As a general sense, we know that

9:21  
this refers to the design and implementation of products, services, environment or facilities to ensure they can be accessed and used by as many people as possible regardless of their abilities, disabilities or limitation. But from the other side, we can also see accessibility from various contexts. For example, from economic context we can say that market accessibility is very important

9:52  
for economy and UH, which means UH. An economic context generally refers to the extent to which UH market is open and available to participants, including business and consumers. And this is I took from Wikipedia. In our modern times we also very often heard about the web accessibility or the accessibility which is the inclusive practise of ensuring that are no barriers that prevent interaction with

10:23  
for access to website on great

10:27  
by people with physical disabilities, situational disabilities and socioeconomic

10:33  
Absolutely. So uh from this UH we can um

10:36  
no uh make this screen to conclude that uh accessibility is something to uh have a access on uh things uh which are very important for our life without any problems and barriers and uh in transport planning the situation is very similar but focused on the topic

11:02  
in in tier accessibility. Uh first measure of the ease of reaching and interacting with destination or activities and distributed in space,

11:13  
for example around city or country.

11:16  
Umm. Accessibility is generally associated with the place or place of origin and uh From here we can see that this is uh very large room of uh uh adopting GIS here

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and uh some uh very often we need to measure accessibility.

11:38  
I'll be some criteria and the place with accessibility is 1 from which many destination can be reached or destination can be reached relatively easy and a lot of accessibility implies that relative field destination can be reached for a given amount of time if it cost or that reaching destination is more difficult or costly from the place. And as I said, very important for the measurement of the accessibility is Predefined criteria assessing Accessibility

12:08  
replace the structure structured approach entailing uh the establishment of clear and measurable criteria. These criteria from the foundation for a comprehensive assessment. For example, I bring some example here in United Kingdom issued a set of instructions for accessing accessibility to green areas known as Accessible Measure of Green Space Standards. And according to these standards, nobody should leave more than 300 metres away from the nearest

12:39  
this place out here uh surface of at least two hectares,

12:44  
one green area of at least UH-220 hectares should be accessible within 20 kilometres. From the residential areas. Boundary area from of 100 hectares should be accessed within 5 metres and one green area. At least five factors should be accessible within 10 kilometres

13:06  
and UH from this UH predefined criteria is UH giving very big room to for example, UH evaluate UH

13:18  
two people in Great Britain and United Kingdom. UH has uh uh good accessibility to green space or not and uh very similar situation. We had UH UH in our project before the starting UH, I mean UH predefined areas

13:37  
UH and UM

13:41  
OHH According to client UH, UH wishes UH. We use the three indexes UH which were Rural Accessibility Index, Market Accessibility Index and Service Accessibility Index UH. This was the key point about which and we had conducted our

14:02  
analysis and measurements

14:07  
UH Rural Accessibility Index is UH introduced in 2009 UH UH And in this context it was a share of rural population living within two kilometres of on all season Rd,

14:23  
UMM. So for this UH to measuring this and UH give some evaluation UH it was very important to have UH idea where to people live and we use global data set of population publicly available for example for POP if you know about this

14:47  
where does the road network exist uh we use uh georeference Rd network uh official uh shape files and excel sheets uh and open source data from open street map for example. And the most important was in what condition are these roads, but this data it was not exist very if it was very fragmented and they're not complete. And

15:16  
for this, we conducted UH, Ground Routing and we talked about,

15:20  
yeah,

15:22  
UH, about UH, Rural Accessibility Index. UH I need to say that UH there is a certain UM

15:30  
uh connection uh between uh uh this index and uh power team uh. For example, you can see here the Mozambique uh case. Uh. Poverty is higher in places where right is low

15:44  
English. Uh. This is uh almost axiomatic. Uh

15:51  
uh other indexes was uh my insight market Accessibility index and Service Accessibility index. My is the fact is the travel time to required for the population in a given area to reach town, city or any other high density population centre. Usually it is a local administration as a point here and when we mentioned the point and as I shows that the average time it takes for the population to reach

16:21  
social services or critical infrastructure such as health facilities, schools, universities and markets and so on. And again, this one was introduced the same authors as relaxing

16:37  
with the index. And the simplest formula for an accessibility index is UH, shown here, where uh S is the size of indicator uh at the target of J. For example, population of the large cities and towns and T is the distance or travel time between origin I and target G&J

16:59  
and UH. As I already said, UH, the UH most important UH part was the UH UH Quality Data Quality Data

17:11  
UH Collection and UH. For this we lose UH use UH the UH application UH for mobile application and the name was UH, wrote Lab Pro.

17:23  
You can see some screenshots UH from this application here. UH rode up UH Pro use accelerometers, gyroscope and GPS to autonomously measure and evaluate Rd roughness on IRIS scale. IRIS is an international roughness index, adopted, accepted and index.

17:47  
You know, just UH, very UH. Often using UH for the road quality evaluation

17:55  
and UM

17:57  
UH for UH.

18:02  
When setting UH for the UH running this application UH there are some UH required preconditions. Minimum speed of the vehicle should be at least 50 kilometre per hour

18:14  
suspension type. You can just use a soft medium or heart Uh. This is depend on which card uh which kind of car you are using SUV or UH? Limousine or I don't know trap and very important is uh

18:32  
it should be vertical and well fixed uh without uh too much uh lifting and uh not tilting uh some as shown in uh this picture

18:45  
and uh. You can uh later on uh check this uh

18:50  
ohh in your house uh phones. It is still UH uh actively using UH

18:59  
and working and available in my store and UH in Play store.

19:09  
Yeah, other settings was um possibility to upload picture or uh uh portals, blackspot or Rd accidents, UH with simple tag and UH and UH you can describe these talks with

19:26  
notes and so on. And all data collected can be UH emailed to yourself or upload to your own Dropbox UH or other UH cloud based storage UH with UH Wi-Fi or with mobile data.

19:46  
In the results of this UH UH Pro which UMM UH UH generated UH was UH

19:56  
uh payment files uh Geo reference UH You can see the screenshot from the uh typical uh folder of uh Rd dot pro and you can see also this Camel product uh different colour of the part you pass where red is the bad condition and green.

20:24  
Good one.

20:27  
And also it uh produced such kind of uh CSV files. Uh, where?

20:33  
No

20:35  
Enough uh. Attributes. Uh Also collected

20:40  
and also we use UH Mapillary Application UH UH for the UH for the monitoring of UH road to have some evidence. And

20:53  
if you don't know about this UH, Mapillary, it's online UH service of sharing your your text, photos and videos UH. For example, I can show UH

21:04  
ohh my page

21:07  
no I during this UH

21:10  
UH project I collected UH about UH 11,000 UH photos UH which uh in distance UH is UH-140 kilometres and you can see here for example. Let me show you some

21:27  
a chain of photos. Uh,

21:33  
that's very good one here.

21:37  
Yeah. For example this one we collected in

21:43  
northern part of Armenia and you can see UH this is the part and then it was started and ended and UH here also it's possible to UH UH it's possible to

21:57  
UH see as UH UH time lapse photo. And you can see that UH, at that moment Rod was not in very good condition,

22:07  
you know, during the Reign and the March. And yeah,

22:16  
can you let me talk back then

22:21  
And UH about UH, UH Ground 20, UH conducted the period of March and June UH,

22:30  
which is UH, UH best UH. For the UMM

22:35  
collecting data, because uh mainly at this moment uh uh Rd condition is not very high and because uh seasonal works uh from uh not working uh not started yet and we draw about 9 1/2 thousand kilometres and it was very important. Also for example in in the roads we just two

23:03  
uh lines uh it was very important to pass two times and umm uh

23:10  
yeah this was mainly uh internal state roads, uh Interstate highways and

23:17  
hmm uh to have complete um

23:22  
picture in the end before James and just

23:28  
uh. Here is also you can see the shape file and was created based on the

23:33  
based on the ground truthing

23:38  
and UH This was the databases UH also translated to local languages UH which was very important that before starting to UH analyse UH the accessibility and this road map Pro is generating

23:56  
in every 100 metres and UH creating shape files times that files with breaks 100 metre sections 100 or 100

24:09  
up to 100 uh 1010 and UH to UH

24:17  
uh sure uh uh continuation of the uh line uh we uh just uh put it uh uh last coordinates uh we managed the last point minutes of the uh in the previous section with the first coordinates of the next section to have this

24:36  
are not distract uh disc uh thread uh line uh shape right at the end which was very important uh for accessibility and knowledge.

24:48  
This was the attribute so you can see staff longitude start latitude and longitude and latitude and speed in kilometres category. Good, bad, uh

24:59  
moderate and so on. Fixed or not, uh international roughness index distance suspensions and surface tag paved or not paved for example. And you can add also some condition provides and so on.

25:17  
And uh accessibility analysis was done and maintained in Geographic Information System. Uh

25:25  
permanent uh I uh mainly use uh at that moment of GIS desktop, but uh uh this uh packages like network analysis, special analysis and model builder. But it was very also fit for example open source in QGIS and so on. Uh, because uh. The code was initially written in Python

25:54  
And uh

25:56  
you can see here uh this is the screenshot of this Python in the tool and we use this UH Uh internationally adopted UH UH

26:07  
um methodology for the UH for the UH Rural Accessibility Index UH condition. And this is the UMM

26:17  
you know, final map produced Rural Accessibility Index where UH the lowest UH UH numbers is. UH means that UH accessibility is UH UH low and fast

26:33  
is. I mean that the accessibility is better

26:40  
and if you compare with the UH

26:44  
for them up UH I show in the beginning we can see that here UH the UH region which was UH which was the highest rate of property has also some in some is part of very low accessibility and once we was very rich has very good accessibility here and year of year ago.

27:10  
And UH for the network analysis and we used to create UH market accessibility index on some service accessibility index maps for example is from map where we show average travel times on the closest to UH UH closest still facility or UH average travel time. So the closest town halls of the towns with the population above 50,000

27:36  
inhabitants

27:40  
UMM and UH. Here you can see for example, as I already said, that UH in this area,

27:47  
in in this region which is the poorest region of Armenia, we can we have a lot of UH red lines, UH and UH more green lines. We have that in the regions which are close to the capital city

28:03  
and at the name of this region is Shirat and you can see here that Shira case only

28:10  
44% of UH UH, rural accessibility

28:18  
and UH, this was very important UH number UH, but UH, uh 66% right is low compared to the EU standards.

28:29  
Yeah.

28:32  
But UH from the other hand UH it was very interesting that UH overall high market and service accessibility because UH UH

28:43  
investigated and during the research in in our country territory. And this

28:52  
graphic shows that UH

28:57  
for the big cities UH-40 per 40 minute UH accessibility is the highest rate and and uh only in some cases it can takes uh uh

29:11  
too long for example. But uh uh in the case of UH UH cities with population of UH above UH 50,000 it has some problems because in Armenia we have only three cities which are situated here, here and here the population above 50,000 and for example from from these regions it is very appears that at the time we took weaker than from these regions. But this is not very correct

29:42  
uh indicator. So maybe uh the used for decision making to this blue one

29:54  
and um market accessibility and service accessibility. Uh as I already said and relation is very uh uh in good position in this matter. And also graphic shows that almost every village, every small community has a

30:18  
or at least 40 minute accessibility to near school or health facility

30:25  
and UH We also did some statistical analysis based on this UH. For example, you can see again that UH proportion of the roads in poor and very poor condition UH with the connection of poverty rate. And we can see that that region in the north part of Armenia which name is Shirak is leading here, leading here Poverty rate and accessibility index. And also

30:55  
reading here where UH population of UH

30:59  
to more than one hour away from the large town. So uh, this was UH gave a room UH for the decision that all the effort should be focused on this region and I know that now

31:15  
they are doing better for this region after this project.

31:20  
And UH lessons, the directions for the future research we learned during the UH

31:27  
UH during the UH study. UH choice of figures. We've got the evaluation of other approaches to assess the project outcomes would be very better. UH for the next time. And understanding of the theory of change linking transport, invention in other high level of outcomes and timing for data collection and evaluation window. Maybe UH March and June is not very good. Between March and June is not very good choice, as I already said

31:58  
at that moment usually UH in UH the regions uh high mountain regions where UH snow is UH usually high UH and UH after the melting of snow roads are usually the image and at that moment usually season works of

32:18  
UH. The measure repairing is started and UH maybe it is UH UH for the good pictures would be nice and to collect that UH after the repair works and so on

32:32  
and the results achieved. Uh to date UH umm uh

32:41  
almost 400 kilometres UH of roads have been rehabilitated to date on decision made after the GIS analysis and Rural Accessibility Market Accessibility Index data was available and according to World Bank statistics average speed of flow lifelong roles in the project area has improved from 20 to 40 kilometres per hour. User perception,

33:11  
you know for improved access to markets and services to increased from zero to UH four point UH, five. UH and the measurement were scaled in between environment, UH, UH five and number of rural population with access to all season. Rd increased from 60,600 thousand to almost 812,000 and share of rural population with access on

33:41  
and also some that increased from the 51% of the total population of Armenia and up to 72 and four

33:51  
and UMM UH in the end For the further reading UH of all this

33:58  
uh, UH methodologies, how everything was done and so on, you can find some paper UH which I have published and UH official report which is available in the World Bank Depository. You can use this

34:17  
things and before uh finishing and uh. I would also share some UH.

34:25  
I would like to also share some UH photos UH from the UH Field collection Uh part of the research When we just started UH

34:39  
Ohh, sometimes we had to overcome such roads Uh

34:45  
uh. There were also such barriers, or uh,

34:50  
even such kind of barriers.

34:54  
Umm

34:55  
me

34:57  
that this condition of uh life during the field work,

35:02  
and sometimes uh

35:05  
there were also um, made us to think.

35:10  
Even desperate thoughts appeared.

35:14  
But uh, at the end, meeting with him, for him

35:20  
or with them,

35:21  
finding such beauties

35:26  
made us look beyond the horizon with optimism and continue our work. Thank you very much. This was second

35:36  
and

35:39  
so thank you

35:42  
in particular for the nice ending.

35:46  
Well, you were sharing some impressions of the wonderful landscapes

35:52  
in Armenia,

35:54  
UH, which of course provide the context for that kind of feedback. So thank you. That was

36:00  
definitely quite impressive.

36:03  
Ohh. From the technology side. There wasn't the meat side. Uh, quickly checking out this World Lap. Though I was not aware of this kind of specific

36:16  
UH, application, which of course is using the standard accelerometer.

36:22  
Thanks we we we're working, or you're familiar with some of the team. Insightful. And of course, our bicyclist team has been using a similar app

36:36  
to look into the quality of the bike lanes.

36:41  
Umm, so it's interesting to see and maybe even worth comparing with that you have pointed out here. So invitation to everyone. Uh, either through your hand, uh, if you have any topics you want to discuss,

36:56  
or to type questions into the chat, or simply to unmute your microphone

37:04  
with any questions you might go forward with. So

37:09  
we have time for quite a few questions. I know you want to start.

37:17  
Hi everyone and thank you are thankfully interesting presentation. Actually I was thinking this um, accessibility is measured only by the time or it's also using like public transport because I think real area people actually have. No, not all of them have a car to access it. Any other city maybe? Yeah, which is nearby. So this was, I was thinking this is maybe one of the major issues why they are

37:46  
uh poor or can I cannot have access to their facilities.

37:53  
Yeah, actually this is very good question. Umm And uh. Umm, this is uh the topic for the next project and now in negotiation with uh, some donor uh Bank. Uh, not UH World Bank this time but uh

38:12  
yeah, I'm Development Bank and which is going to finance such kind of and uh,

38:19  
very happy that uh they again addressed to me UH for such for such. Yeah,

38:28  
because uh, uh, maybe you know, umm, you know, so comparing with standard UH, umm, not very developed uh public transportation for regions is existing in, I mean and right now it is going to be solved.

38:46  
OK. Yeah, that's

38:49  
very good points, excellent. Once thought we just going to put my mind and it was listening,

38:55  
you were very well illustrating the impact and the links with properties in peripheral disadvantage or less accessible regions

39:08  
in some way from a planning, from a road infrastructure development perspective.

39:16  
The question could be turned around

39:19  
somehow as well, like I would have a certain budget available.

39:24  
Where, uh would I get the as they sometimes colloquially say the best bang for the buck?

39:32  
Yeah, if I have a certain budget available, uh, sometimes maybe there would be a long road which is quite OK, but there is a bottleneck like that could be a bridge or one way plane or a stretch of Rd which is good quality or under risk of natural influence, things like that. There's kind of speaks plain case, but we could look at where would we make the most difference with certain amount of investment.

40:03  
For the infrastructure,

40:05  
Ohh, was that part of the question as well or would you suggest to use the same approach to ask that kind of infrastructure budgeting question?

40:19  
Actually this is also very interesting that you raised this question because the World Bank is focused not on state and Interstate roads which are usually in very good condition

40:34  
during the last season. But UH links between the UH for example small villages and Interstate road and UH the the name we are calling them a lifeline roads and this was yeah and investment doesn't UH went to the roads feature in general use. So particularly they went to the

41:01  
regions and UH communities. UH, which are mostly, UH depended on the road and as I already said so that such kind of works are called lifeline routes.

41:16  
OK, yeah, thank you for for explaining that because I I noticed the time in your slides and I wanted to ask what that means. So that's the local access roads to village, sometimes the end of the road

41:31  
they then accessing your village and connecting them to the regional and national network. Yeah. So that's how the junctions from the regional or uh, Interstate routes to the certain community.

41:47  
OK, Yeah,

41:48  
Ohh, yeah, it can. Let me invite uh, anyone else about it. One another question. It's certainly a topic which is highly relevant pretty much everywhere in all types of economies, all kinds of environments. Sometimes it would be like you posted it here,

42:10  
Ohh poverty would like it. So looking at social demographics. In other cases, it might be more, UH, related to economic development, regional development,

42:23  
UH, like places for certain types of industries or access to markets

42:28  
or particular kind of products.

42:32  
Yeah,

42:33  
uh,

42:34  
speak to you. You were looking into the

42:38  
EXISTS obviously

42:41  
UH with the poverty UH concept

42:46  
but to to UH the the main bodies in the country as well. Would that be turned around into some kind of regionalization

42:58  
uh so to to look into allocation questions like UH looking maybe at the hierarchy of regional centres

43:10  
and this of course might change as well if you expand and both one connection actually the the regional structure of the country of the region might change right. So if you look at

43:25  
UH, that from an allocation perspective to centres, would that be part of the question you're dealing with as well?

43:33  
Actually no. UH but UH UH after, as I already mentioned, at that moment UH some administrative UH changed UH.

43:44  
I'm going UH and UH before UH UH a couple of years ago Armenia has a UH. This UH free level of UH

43:54  
no administration divisions, UH country UH regions and capital UH region. Also it has a UH status of region and towns and villages which was self managed. UH UH, self managed

44:14  
and

44:16  
and I

44:18  
need to send along independent and self managed that. But after that, uh, some processes started which is still somehow ongoing. Uh several

44:30  
uh small communities, UH merged with uh UH closest UH closest big community, usually city and we just status of city and UH they generated like in large communities we are calling now And this is also drives of change in decision making especially in infrastructure and UH yeah from this perspective

45:00  
yeah. Another UH answer your question is yes. Yeah. And somehow it just affected and UH, somehow UH, allocation and allocation, UH, UH processes are linked. But at that moment when I signed into this project.

45:17  
OK, Thank you. Yeah. And particular insights book. We have one interesting example. Right now we have one this book which is the part of the province of Southport north of the city of Salzburg.

45:32  
And the this point at installation centre traditionally was located in the city of Salzburg. Because all the roads of the region go to South Bucks, accessibility would be easier and with a bit of a decentralisation idea, the district administration was moved out from the city of Scottsburg to Seekirchen, which is a minor centre or some 1520 kilometres north,

46:04  
and so that was a good idea to reach analyse. On the other hand public transport. But I know I was saying before, accessibility to this regional centre is much, much worse than going to the city.

46:21  
So that is a lot of interplay with planning decisions which all have some legitimate objectives. So I was just thinking at this objective. So I don't see any other questions. So let me make that the last call. If anyone wants to jump in please voice your hand or speaker

46:42  
and as they don't see any of these like me thank I'll talk to you again. I think that was a great learning experience in many ways. Like you know aspects you use in sorry, sorry professor. I see some questions in chat maybe ohh sorry then I have not looked at that.

47:02  
Wait,

47:04  
uh, no, I don't see that. But yeah, if you have it, then please go ahead with that.

47:10  
Umm,

47:14  
yeah, I see here. Uh from uh uh, how do did you select the participants? Did you also analyse difference between the movement between demographic groups, age, gender etc? Actually in my part was not dealing with these topics. But in general it was very interesting that parallel of the within the framework of the project, parallel of mice.

47:41  
And this was also some very interesting thing UH regarding to demographic and UH mainly regarding to the migration. UH again UH, GS and remote sensing played huge role. Here people analysed the illumination during the night between the seasons, for example summer and the

48:02  
in winter UH to measure UH migration. As I already said and said, certain migration, UH seasonal migration is existing in Armenia and people are during the summer going to

48:16  
foreign countries for the working and coming back UH during the winter. And UH, we UH analysis and the elimination rate shows that I believe the winter it is very high usually and during the summer it is very low. So, OK, so I think Helen, the question was actually from last week, right, but it it was matching here as well. I hope I didn't overlook any questions you might have had,

48:45  
uh, today. So,

48:48  
OK.

48:49  
Yeah. Thanks Helen for confirming that.

48:52  
Yeah, going back again, I'll talk for the for the great overview in particular in the introductory section as well. So learning about the like the international connectivity, like the access to the Black Sea, so Georgia, that's of course modern macroeconomic aspects coming in here less related to the well-being and life levels of individuals.

49:20  
But it's quite clear that all of these factors play together again. This case study I believe was an excellent example of the power of network analysis of everything related to. So this path level time, ease of travel, allocation, centres, hierarchies of centres which is highly important for all for many of the planning well,

49:50  
the task where we apply our tool sets from the informatics. So take care, talk for the illustration. Thank you very much. Hope you get better soon.

50:01  
Feel all healthy again. Thank you very much for joining us here today.

50:07  
Goodbye for now for today. So everyone else, see you next week, UH, for another talk which will be a little bit closer to home. It will be related to some work in the Garden National Park. That will be next week,

50:27  
public and otherwise wish everyone a good start into this week. Thank you again. Goodbye. Thank you very much. Bye, bye.