Interview 9

Interviewee	09-Esri-O
Interviewer	Ashraf Shaharudin (TU Delft)
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Interviewer
So my first question to you is could you please describe the general approach and vision of Esri towards open data?

Interviewee
Yes, great question and I think well, one thing I'd like to do is define what we mean by open data. Esri has, I would say 2 definitions for it. One is data that is shared publicly for use within ArcGIS software and other GIS software, so that implies that the data is open functionally that it's accessible to anyone, it can be accessed anonymously, and it can be shared with others publicly, but it doesn't presume a specific license agreement for the data. It would be up to the end user to define what license agreement that is.

A narrower definition would be including what I described above, but would prescribe a specific type of license. There are of course many different types of open data licenses that someone might choose. It could be public domain or Creative Commons or ODBL, or several of those, but there would be some open data license that granted some fairly broad permissions for the use of the data with some constraints.

So I think Esri is interested in providing access to both of those types of data, but we don't always require that the public data be shared under an open data license because there may be requirements that the publisher has, whether it's simply for attribution or it's for, specific types of use cases that may not be permitted that we want to give users flexibility to enforce.

Interviewer
And how do Esri approach open data in general?

Interviewee
So for the past several years Esri has done a few things with regard to open data. One, we want to make sure that ArcGIS as a software system is useful for creating and disseminating open data. So one approach we have is building technology that can be used for the creation of data, of course, but then more importantly in this context, the dissemination of it as open data. So that includes hosting the data in a file format in, for example, a cloud environment from which users can access the data, but then also publishing that data as ready to use services that can be accessed through open API's-- that could be a RestAPI, WFS API, WMS, WMTS, different open data protocols that are accessible. So one approach is facilitating the creation and sharing of open data.

A second approach really is more about the curation of open data. So ArcGIS as a system is also a repository of geodata and ArcGIS currently has, ArcGIS Online I'll say specifically, currently hosts over 50 million objects of data that people have created and then those objects could be of many types-- they could be files of data, they could be services like I've described, or they could be apps or maps that reference those services, and those could also be created as objects in ArcGIS. And then a user when they've created an object, has the control of how that object would be shared. I'm going to refer to those objects as items, if you don't mind. They are items in our system. So if I create an item, let's say I upload buildings for Rotterdam and I can store those as a file as one item, I can publish

them as a feature layer as a second item (that's a live service representation of the data). And then I might wanna share both of those items as open data and then through ArcGIS, I can use the sharing tools to choose to share that data with everyone and then I can also choose to share it with open data groups that will expose the data through open API and through open data portals and so that it facilitates the discovery of it. And so I would say that's the second approach for Esri is provide a collaboration platform or sharing platform through which users can publish data and then control how broadly accessible it is, and then control, how it's described to users, with formal ISO compliant metadata, if that's required. And also, affixing open data licenses to that through the sharing process.

Interviewer
This platform that you mentioned is living Atlas. Is that the platform that you refer to?

Interviewee
Yeah, great question. The way I was describing it was even broader than the living Atlas, but yeah, let's transition. So if you think of it, it's kind of like a Venn diagram where there's -- let's say -- there was the collection of the full set of items. So there is -- let's say I'll use round numbers -- 50 million items that have been created in ArcGIS as a system, then a subset of those items would be shared publicly. So of those 50 million items, maybe 10 million of those items would have been shared publicly. The other ones would be privately managed by the owner of the item or the organization that created the item, but not shared with the public. So there's the larger set of maybe 50 million and then the smaller set of 10 million that are that are public and then a smaller subset of those public items would be what's included within Living Atlas. And what's included in Living Atlas is a curated -- an Esri curated subset of all of the public items and it's curated based on its quality and its usefulness to a wide audience. So Esri staff at Esri Inc, but also at Esri distributors such as Netherlands and UK and Denmark, would be curating content for their respective areas of interest. Esri Inc would curate content for the world and for the United States because we're the distributor for the United States, but Esri Netherlands would only curate content for the Netherlands, for example.

Interviewer
So say that's an individual data provider that is not an institution, say they are a group of researchers and they want to publish data as an open data on living Atlas. So is that something that then Esri Netherlands or Esri Germany would curate as well? Or they only curate from authoritative providers?

Interviewee
Great question. It could be it could be either. So it could be a student in a university or a faculty member in a university that has a personal account and they could create content and share that content publicly and that could be nominated to Living Atlas. Or they could be a member of an organization. That organization could be a university that has faculty members, and they may be attached to that university as an employee of the university, and they could publish content not as a personal user or as an individual user, but as a member of an organization and they could publish that on behalf of the organization if they wanted. And then it could be a commercial organization or a government organization as well. So I would say that the majority of content that's published online and nominated in [to be] included in Living Atlas is being done by a person on behalf of an organization. But it is an option for an individual user to do that as well.

Interviewer
But at the end of the day, it's the individual Esri in those countries that would determine whether they would include those data in the Living Atlas.

Interviewee

Yeah, that's correct. The same curators would apply in both cases and the same criteria for curation would apply in both cases as well.

Interviewer

And since when Esri has been providing this open data services for both approaches -- to provide open data and also as a curator, as a platform?

Interviewee

Providing the technology for delivering open data, I would say for about a decade. ArcGIS online has been around for a little over a decade, since around 2011, I would say when it became available. And soon thereafter we began to support open data sharing formally through ArcGIS Online; so roughly 10 years that we've been doing that. And then it's been a little less time than that maybe seven or eight years that we've had this concept of Living Atlas that we're actively curating on behalf of organizations. The enabling technology for that has been around longer, in terms of having desktop software for the creation of data and server software for the dissemination of data, that's been around over 15 years. But it was up to the user of the technology to attach licenses and control sharing, through their server infrastructure; we didn't provide that for users. Beginning 12 or 13 years ago we started doing ArcGIS online where we provided -- hosted infrastructure for that, as kind of, when we began facilitating that as a service rather than as software.

Interviewer

And what is the business rational in providing this open data services to Esri and also to Esri's customers as well?

Interviewee

Yeah, this has become an increasingly important part of the value proposition for Esri software. So many years ago, 20 or 30 years ago when people were buying Esri technology, they were primarily buying it for their own internal use. And an organization would license the technology and they would compile their own data using the technology and they would use it kind of within their organization. And there might be some amount of data sharing between organizations, but it was done kind of through very simple tools like FTP data sharing or shipping data on external drives and connecting it. So before the popularity of the Internet in the 80s and 90s, in early 90s in particular, it was very isolated, insulated infrastructure and systems that people built. But beginning in the late 90s and then expanding dramatically in the early 2000s, these systems became interconnected. Technology like Google Earth was released that was software technology came with a very rich set of data kind of in the box with the software, if you will. And it reset the expectation for users of geospatial technology that the data was built in to the software. And because of kind of that expectation and because of the growing availability of data, and because of the expanding connectivity of the network and bandwidth connecting systems, very quickly over the last 15 years, that's changed. So now Esri considers data to be and what we call content kind of generically content, not just data, but apps, maps, layers and tools and other types of geo-data content, is an integral part of the ArcGIS ecosystem. And now when organizations use ArcGIS software, by default, they have access to many petabytes of data through their Internet connection. And you no longer need to individually organize and assemble all of that data; it's available to you at your fingertips. So the value proposition of GIS software in general and ArcGIS software in particular is much greater because it's not just the capabilities of the software that we can deliver, it's all of this ready to use content that is accessible if you have Internet connectivity. You can bring that into your system of record and rely on the work that others have performed to complement your own work.

Interviewer

Do you see any increase in the subscription of ArcGIS software since the introduction of open data services?

Interviewee

Absolutely. Yeah, I think that we've seen exponential growth in the adoption of our software as a service technology, ArcGIS Online since its inception. It's grown steeply, it's one of our most growing product lines. We attribute that to a few things. But I would say it at the top of the list is the ability of users to access ready-to-use content, including open data content, kind of in the broad definition of how I described it, publicly accessible content including content with open data licenses. That's a significant value proposition for users of software as a service. And then the inverse of that is the ability of them to share information. So I'll use a simple example of the public organization in the United States, like FEMA, the Federal Emergency Management Agency. They have a mission in the United States to share information with the public about a disaster, events, and disaster risks. So, for example, where communities are at risk for flooding and so for them they have to publish maps that show the public what properties are at risk for flooding and they maintain their own flood data polygons. In the past they would have to not only maintain those, but all the collateral information: street networks, building footprints, terrain data, all of the ancillary information needed to illustrate and understand the flood polygons. But in the past 10 or 15 years, all of those other types of data, imagery, street maps, elevation maps, building footprints that are being built and maintained by other organizations outside FEMA as all that information has become accessible to FEMA through web services, they can now focus on their core mission and then they can still produce information products with their data combined with useful data from other organizations; in many cases, open data under open licenses and then disseminate that out to their users, which is a tremendous savings of time and money to do that work. And that's one of 10s of thousands of examples of that that we see around the world of organizations leveraging the work of others. We think of that as geospatial infrastructure that's been built and we also think of it as a web GIS pattern that's emerged over the last 20 years.

Interviewer

Hmm, that's an excellent example. But what are the challenges that Esri face in order to provide this open data services?

Interviewee

There are several challenges, I'll try to break them down. One of them is in infrastructure, so the physical and network infrastructure for that. As those petabytes of data have been built, making that available to users in a highly scalable, highly reliable, and highly performant way was a challenge. When we began this process 20 years ago, we had to build out all of our own infrastructure for that. We bought our own physical hardware, we set up our own data centers and we developed our own technology to do all of that, but that was not sufficiently reliable or scalable. So one of our challenges that we've largely overcome in the last five years has been migrating all of that infrastructure to the cloud. So the system that I described earlier in ArcGIS Online, at this point almost 100% cloud based, where all of the Esri content that we aggregate and publish is hosted in commercial cloud infrastructure. And then all of the data that our users share through ArcGIS online is published through commercial cloud infrastructure. And then we've built into the software by default, all of the tools needed for that content, not only to be publicly accessible, but to be highly scalable. For example, one of the applications that we supported in the past few years was the Johns Hopkins University COVID Dashboard, which was one of the most popular apps that's ever been released on the Internet. I think there are well over 1 trillion views of that application alone and it's

been viewed by billions of people around the world; and that was not possible to do 10 years ago. But by leveraging cloud infrastructure, we were able to make that possible for an individual university and a student within that university to publish data that was seen by billions of people that relying on that. So infrastructure as a main challenge of that.

The other I would say is around the governance. Speaking of the Living Atlas aspect of it, defining kind of the governance rules for curating content from various organizations, what are the acceptance criteria for data that would be featured in the Living Atlas both from a quality perspective and from availability perspective. And then building the tooling to manage that. So we've developed tools that inspect data that's nominated to the Living Atlas to meet some minimum bar of quality before it can be nominated to the Living Atlas. And then we built tools for the curators of that content to review it and communicate with the contributors and accept that content into the Living Atlas and share it. So the governance aspects around the curation of the Living Atlas.

And then I guess the last piece I would describe is the tooling for the governance and the enabling of data sharing for open data in general. So outside of Living Atlas, the ability of organizations to use ArcGIS as a platform to publish their data and then to nominate it or share it as open data in the open data system so that users can then use other software tools to discover the open data, filter it by its characteristics, including its open data licenses, and then access the data through APIs or download for offline use -- kind of building the tooling necessary for that open data governance.

Interviewer
And I imagine individual Esri distributors would also face quite similar challenges themselves. So what are the support that Esri Inc provide to them in terms of training probably or in terms of infrastructure in order for them to also overcome these challenges?

Interviewee
So yeah, it's both the training and the infrastructure that Esri has provided support for. So on the training front, there's a couple things. One, we of course create documentation for the tools that we build that we then disseminate with the curators. So we have a documentation for the public tools that our users can leverage, but we also create documentation for the internal curator tools that we build. Then we communicate that through kind of training events. So we've done a few different types of events. We have an event called a Content Immersion program event that we've been running now for several years where we invite Esri distributors to come to Esri Inc in our headquarters in Redlands, CA and spend several days working with our content development team and going through the goals of the team and each of the individual aspects of what the team is working on, the different projects that we're supporting, including the development of the website and curation tools. We use that as an event where we can collaborate, where Esri Inc is providing education to the distributors but we're also hearing back from the distributors what their unique local challenges are and then collaborating between the distributors because in many cases, their requirements and their challenges are similar whether you're Esri Denmark or Esri Netherlands, your challenges are similar. So they work with each other and then they work with Esri Inc and then we iterate on the tools. So that's the content immersion event we have.

We've also done content summit events in different parts of the world like in Europe we've had annual content summit events in different countries where we gather people from the region to collaborate and focus more on local issues to that region.

Lastly, we have recurring virtual meetings where we broadcast information using tools like Teams to disseminate updated information in between these annual events that we hold. So we do a lot of those types of training with the distributors.

In terms of infrastructure, we've built a curation tools for the Living Atlas that are hosted in the cloud and we set up accounts for each of our distributors that are curating content for them to sign in to those tools and then those tools are built so that if I'm the curator for Esri Netherlands, for example, I'm assigned items that have been nominated to the Living Atlas that are relevant to the Netherlands. Our tools auto assign things based on some AI technology that we have, inspecting the items, and determining what region it's most likely applicable to and then assigning it to the curators; but we can also manually reassign things as necessary. So that's the other aspect of the infrastructure, it's kind of the web tooling that we've built for living Atlas curation.

Interviewer
The cost of hosting this data in the cloud are borne by the individual Esri distributor?

Interviewee
In some cases it is. So that's a good topic. So I described kind of how the content is curated. So, Esri Netherlands, for example, will typically curate content within the Netherlands. But if the content extends beyond the borders of the Netherlands, maybe it's pan-European content or its global content, then that typically would not be handled by the individual distributor. That would typically roll up to Esri Inc. So in general, Esri Inc is responsible for hosting content that's global in scope and in many cases continental in scope, but goes beyond individual countries. The individual distributors are typically responsible for hosting content that is specific to their individual country. So for example, Esri Netherlands would be hosting data for the Netherlands, Esri UK would be hosting data for the UK, but Esri Inc would be hosting Sentinel imagery or Landsat imagery that's pan-European or global in in scope, as a general rule. And Esri Inc would also be hosting content for the United States because we're responsible for the US region.

Interviewer
And how does the varying level of open data in different countries affects the open data services that Esri provide as a whole?

Interviewee
Yeah, that's a great question. And that's one of the reasons why we like to work through our local distributors because our local distributors, are most familiar with what the local rules and regulations are with respect to open data. So for example, in the UK there they have a set of open data that's been made available by the UK Ordnance Survey, but there are restrictions still on how the data can be used. As the [Esri] UK is most familiar with that, those rules and regulations, they have the direct relationship with the organization sharing the data, such as the Ordnance Survey. And so they're able to make informed decisions on what data should be made open in ArcGIS and they can work with that organization that's publishing the data, such as the Ordnance Survey to maybe have them publish that data directly, or if needed, they can take that data from the organization and host it themselves within ArcGIS Online -- within their own Esri UK accounts in ArcGIS Online. And so we typically work through the local distributor on that. If the data is global in scope, then Esri Inc takes on that responsibility as I described, and then we will study the rules and regulations, we'll coordinate with the organization that's publishing the data, we'll determine whether it will be published by that organization or it will be published by Esri Inc and then we will facilitate that.

In general, Esri's preference is to have data hosted by the authoritative organization that publishes it. So, for example, going back to my FEMA example. If FEMA is going to publish US flood zone risk areas and they make that available as open data as they do, our preference would be that not only do they make the data available to download maybe as a file, but that they publish it as a ready to use web service and that it be published from FEMA and marked as authoritative from FEMA, because that will build trust from end users that this is the official data from that organization. But if they don't have the mandate to do that, or they don't have the resources or infrastructure to do that, Esri Inc or Esri distributors will often take on the responsibility of doing that. We will take the data that's been shared openly, maybe as a file, we will publish that data as a service and we will share it as open data through ArcGIS and then we will very clearly indicate that this is the data from the authoritative provider, in that case, FEMA, and we'll provide links back to where the data originated. But it will also be clear that this is being hosted by Esri and not by the organization's themselves.

Interviewer
Yeah, but what is the general approach of Esri for countries that the availability of open data is very low. So how do Esri provide content to ArcGIS users for countries like this?

Interviewee
Great question. So in in countries like that, Esri will look for other sources of open data. So let's take an example of India. There is some open data from the Government of India but it's not anywhere near as extensive as it is in other countries like the Netherlands or France or the UK. So in that case, Esri will look for alternative sources of data; so that could be other open data that's not originating from the governments within India, but from other sources such as OpenStreetMap or other sources like that and we'll make that data available -- we can talk more about that in a minute. We will also look for commercial datasets that might be available for a country like India. So in the case of India, we have commercial data from imagery providers like Maxar, street data providers like HERE, boundary data providers like Michael Bauer Research. Because we have demand for good content in India both from users in India and users around the world, then we will license commercial data and in some cases we can make that publicly available, so you can access it anonymously, but there isn't an open data license. And then in other cases, it's not made publicly available, it's made available by subscription -- you need to have an ArcGIS account in order to access the data and in some of the cases you might actually need to pay money to have access to the data, depending on the business relationship we're able to arrange. So essentially our strategy is to use local open data where it exists, but where it doesn't, we'll look for global open data where it exists or we supplement it with a global or local commercial data, if necessary.

Interviewer
Do Esri Inc monitor or assess the implementation of open data services in different countries -- by Esri distributors in different countries?

Interviewee
We do. Yes. We want to keep track of the health of the open data ecosystem around the world. And so we do that by measuring it in different ways. One of the ways we measure it is by counting the number and types of open data that's available by country. So we will have dashboards that indicate how much open data do we have country by country around the world. And then we will encourage distributors that are have that have less open data to pursue more sources of open data for their individual countries and essentially score the quality and quantity of open data within individual countries. We don't do it -- there's no penalties if you don't have open data because it's not always an option for individual distributors and they have limited capabilities and resources, but we do

convey the importance of having that type of data in the system in terms of making the system useful and we do strongly encourage distributors to add more where they don't have very much.

Interviewer
And so if you may, which Esri distributor would you say are the exemplary in terms of providing open data services?

Interviewee
A great question. In terms of open data, I would say Esri Netherlands is at the top of the list as probably the most exemplary. They have the benefit of having a very rich ecosystem of open data from the Dutch Kadaster. Esri UK I would say is also doing quite well in that regard. Esri India has actually done quite well in terms of publishing public data, but not as much of it as provided under an open license, but they've done very well in aggregating data that's publicly accessible and making it available through the Living Atlas. I would say those are the ones that are kind of at the top of the list. If you'd like, I can check our latest dashboards and give you a couple more examples.

Interviewer
Yeah, that's good enough information for me. Now we're gonna move to the topic of Esri in the open data ecosystem. I wanna talk about the Overture Maps Foundation. How does it come about, what was the motivation and what made Esri participate in this initiative as a general member?

Interviewee
Yeah, I'm gonna go back a few years, if you don't mind, kind of to the prequel for Overture Maps Foundation. So starting a few years ago Esri began working with OpenStreetMap data and we started collaborating with a couple commercial partners such as Facebook, now Meta, and then also Microsoft, because they were also interested in working with OpenStreetMap data as open data. And OpenStreetMap is a great repository of open data but it's also got challenges. Because it's built by a crowd sourced community, sometimes things or features are added to OpenStreetMap that are problematic; there might be vandalism that's added to the map or there may be bad data edits that introduce topology issues, things like that. So Esri started collaborating with those other companies, Meta and Microsoft a few years ago to improve the quality of OpenStreetMap data and to also make Esri data from the Esri GIS community more accessible to the OSM community for editing open street map. So a lot of open data from GIS organizations was integrated into OSM editors to make it accessible to the OpenStreetMap community. And then things came out of that project, like the OpenStreetMap daylight distribution, which is an alternate distribution of OSM data that's been cleaned up and enhanced by fixing vandalism, fixing topology issues, and adding other sources of open data from organizations like Microsoft. So that work -- that's kind of the background work that was happening and that was quite successful. But beginning last year, some of those same organizations, Meta, Microsoft and then also AWS and TomTom, began thinking about additional ways that that type of open data could be improved and improving things like the structure of the data by more well defined schemas that would allow the data to be used as inputs to a wide variety of web services that could be built and used by developers. And so that was the kind of basis of the Overture Maps Foundation; these four organizations became founding members of Overture Maps Foundation with a mission to provide a new open map database that was global in scope and was designed to support the needs of mapping platforms, building services to support developers and building of applications. So that was launched last December and Esri became aware of that initiative and it did align well with some of our goals for making open data available to our user community. And Esri was interested in seeing that open map data initiative become successful. We were also interested in seeing data from our user community, our GIS user community included in Overture data that was not already part of OpenStreetMap but could be part of Overture. And we were also

interested in seeing Overture become more and more useful as a data source for web services that Esri would build and make available to our user community. So in short, we felt like we could contribute to overture and add value, and we felt like we could use Overture to publish services that would add value to our user community. And that's what drove Esri to decide to participate. So we joined Overture in February of this year, and since then we've been collaborating with those other organizations and other organizations who are participating in Overture to help build out the initial set of open data that will be released by Overture this year.

Interviewer
And what sort of contribution that Esri would contribute to Overture? Is it through data sharing? Is it through human resources?

Interviewee
It's through both of those. So the way Overture works is organizations -- Overture invites organizations to contribute in different ways. Data is one of them. Human resources for building tooling is another one. Infrastructure is a is a third one. In the case of Esri it's kind of all three of those things, maybe in that order. So, one is data. For the past 10 plus years, Esri has through the Living Atlas, under the umbrella of Living Atlas, has built out a program we call Esri Community Maps. And that's a program through which, as we users who are part of our user community can share data that they would like to see included in maps that Esri makes available, our image maps, our street maps, our elevation maps and so forth. And over the past decade, we've received contributions from thousands of organizations from around the world, and we've assembled hundreds of millions of features of data and tens of millions of square kilometres of imagery and elevation data. So we have a very large repository of data that's been contributed to Esri. And then beginning a few years ago, we asked those contributors if they would like us to reshare that data with other open mapping platforms under an open data license and a large percentage of those organizations who share data with us have said yes, you may also share it with other organizations. So we began sharing some of that with the OpenStreetMap community and now we're sharing more of that data with the Overture Maps Foundation. So we're contributing data. We're also contributing some staff resources to help define the schemas for Overture and to help build some of the information products that will come out from Overture.

Interviewer
And just to clarify, so in the end, the Overture maps would be under open data license or it's shared among developers?

Interviewee
The data produced by Overture Map Foundation will be shared publicly under an open data license and it will be freely available to any organization to use as open data, internally or externally.

Interviewer
And what is expected from individual Esri distributors to support the Overture Maps initiative?

Interviewee
Esri is encouraging distributors to make open data available for their countries and to help integrate that data into Overture where it makes sense. So, for example, Overture is initially focused on a few different types of data, specifically roads, buildings, administrative areas, and places. That's the initial focus of the project although that will definitely expand over time. So for each of those types of data, we are looking at what open data exists. So for example, in the Netherlands they have buildings that are available as open data. So we're looking at how those buildings can be integrated into the open

data that Overture Maps Foundation makes available. And we would ask kind of each of the distributors to, one, think about what data could be made available and, two, help prepare the data for use within open map projects like Overture.

Interviewer

OK, now I want to talk about how Esri position itself within the global development of geodata. Does Esri see itself as a leader that steer the future direction of geodata development or does Esri see itself as a software company, not so much of a data company, hence, would rather sit back and adapt to the development of geodata?

Interviewee

I think it's a mix of those. Esri is first and foremost a GIS software company. That's our primary mission is to build tools to empower the GIS community to do their work and be successful. But as I described at the beginning, the expectations for that today are very different than they were, 20-30 years ago. So in order to provide useful GIS technology today, you need to be a data company to some extent. That doesn't mean you need to develop the data from scratch but you need to deliver the data as part of your software solution, whether that's an on premise solution running on private hardware or a private cloud, or whether it's software as a service running in a public commercial cloud environment, the data is an essential component of the GIS system. So Esri has become a very large data aggregator where we are hosting petabytes of geodata and making it available to our user community. And in doing that, we're also taking on responsibility for defining schemas for certain types of data, providing tooling for ingesting data into those schemas, providing tooling for publishing that data in many formats through various APIs, like open APIs, to make it broadly accessible. So we are data aggregation organization.

And then in some cases Esri wants to provide leadership in terms of what types of geodata are important and useful for different applications. So, we are also creating types of data that did not exist before. A couple examples of that would be -- one of the one of the missions that's important to Esri is managing the environment and conservation. Esri started as environmental Systems Research Institute many years ago, and that's still in our DNA, we're still in environmental company at some level. And so we are interested in producing information products that help organizations manage the environment. And so we'll take -- we've built things like a global land cover dataset that is built using open data like Sentinel imagery but then applying tradecraft to that data to generate land cover maps that can be used to track land cover change over time. So we have the ability now to generate annual updates to land cover from a recent satellite imagery and deliver that as a new information product by combining our software plus our tools plus our tradecraft to produce an information product and then disseminate that information product to our user community to make better decisions.

Interviewer

And how do Esri distributors perceive this vision? Do they also share the same vision as Esri Inc?

Interviewee

Yes, our distributors kind of have different responsibilities. At one level, they are our software distributors that are responsible for supporting our local community and providing technical support and professional services to help with the implementation. But Esri as an organization globally, strives to have a shared vision of what the purpose of the organization is, what the role of our technology is, and what the kind of important goals of the company are across the world. So conservation is kind of a global mission for Esri and we encourage our distributors to actively participate that in that mission to the extent that they can. And there's there is significant variability

between the distributors and the resources that they have, human resources, data resources and so forth. So there's quite a bit of variability, but to the extent that they can be part of that global mission that strongly encourage and where we can assist them in that, like if they're lacking in infrastructure, we can help fill that gap at Esri Inc, but they can still provide the local knowledge and maintain the local relationships to help apply that mission to their part of the world.

Interviewer
Do you have any suggestions or wish list from Esri on how other actors, data providers, data users and even data standards like OGC should do to ensure a more sustainable open data ecosystem?

Interviewee
We do, for sure. So we think it's important that there be strong geospatial infrastructure, like I said before. So what that means to us is that organizations that are responsible for producing useful geodata, like national mapping agencies, state and provincial governments, local governments, conservation organizations, those organizations should be thinking seriously about how, what is their strategy for making that geodata broadly accessible. And that's both, what's their business strategy and what's their business model that makes them a sustainable organization but allows them to share that data broadly? What's their technical strategy? What is the enabling infrastructure they're going to use to publish that data in a way that makes it accessible, reliable and scalable? That might be using Esri technology, which would certainly encourage that, but it could also be other sources of technology. And then we want them to think about the licensing of that. We do encourage people and organizations to share their data as open data where possible, and so we try to encourage that at the governance level, use open data licenses like public domain, PDDL, or creative common zero to make it as broadly accessible as possible. So that's something we strongly encourage the geospatial community to do.

And then we would also encourage them to kind of follow best practices, document your data well so that people understand what it is, provide access to terms of use, any restrictions, attribution requirements, all of that so it's kind of auto discoverable and reduces as much friction as possible. What we would love to see is a web GIS infrastructure where the most useful, the most authoritative data around the world, is accessible to all geospatial professionals, and even to the public at large through applications built by professionals to make informed decisions, kind of, at the government level, but also at the individual level. So that's kind of an overall mission we've had for Esri for decades. It's exciting for us now because we're just at the point that we envisioned 30 years ago, it's just becoming a reality now. So the technology exists to do all the things that I described. It's really just the mandates from each of the organizations and the execution on that work by those organizations.

Interviewer
Do you have any wishes to the data users?

Interviewee
I guess I would encourage the data users to look for the authoritative sources of data where they exist, to encourage those sources that have data that's not shared as web services to encourage the sources to do that. So for example, if there's a government agency that's producing data that you'd like to use, but it's not available to you as open web services, as a user, I would encourage you to encourage them to do that so that that becomes -- hopefully they'll respond to their data users interests and do that, not just hear it from Esri, but hear from the data users themselves.

And then for those data users, I would encourage them to share their work. If you create an app or a story map that is valuable to you, it's probably valuable to somebody else and share that back and explain what you did. Use it as inspiration for others to do the same types of things, but also maybe train users on how you can do what you've done successfully. So engage in the process, don't just be a consumer, be a creator and share data with others too.

Interviewer
Thank you so much. Those are my questions. But just as a final question, do you have anything that you would like to share with me that I didn't ask that perhaps you think are important for my research?

Interviewee
Thought you asked a really good set of questions. So yeah, congratulations on that. I think probably - maybe a little outside the open data, but I think one of the challenges that is going to need to be overcome is what's the sustainable business model that will work to keep this data open for the long haul. I think a lot of organizations like the Dutch Kadaster and the Ordinance Survey are feeling their way through that process that they've been receiving government funding and in some cases they have full government funding to produce the data and share it as open data. But in other cases, they've relied on royalties or license fees for maintaining the data. So what's the business model that will allow high quality data to be continually maintained in the future while still making the data open and broadly accessible? And that's a challenge I think we're still looking for the right answers. I think we're still in the experimentation phase of that and it's not clear, what business model is going to win. Esri is experimenting with a few of those, but it's not clear to us either yet what ultimately will succeed.

Interviewer
Thank you so much. I'm gonna stop my recording now.