SPIDER
EU-LAC Digital Partnership

Survey on the digital ecosystem interconnectivity in LAC and EU

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EXECUTIVE SUMMARY

This report, Deliverable D2.1, presents the findings of a comprehensive survey conducted by the SPIDER project, which works to foster and promote the longstanding EU-LAC collaboration for an inclusive digital transformation. The survey aims to evaluate the current state of the digital ecosystem interconnectivity, as well as the awareness and use of the infrastructure and services provided by BELLA (*Building the Europe Link to Latin America and the Caribbean)* Infrastructure through the European and Latin America NRENs. To evaluate the potential of BELLA, the survey also explores the technology areas and applications that can take advantage of BELLA to support the digital transformation and identify key barriers to unlocking BELLA's full potential*.*

Conducted across Latin America, the Caribbean, and Europe, the survey analyses the connectivity requirements for daily activities in research and business and the knowledge and connectivity provided by NRENs in both regions. The survey also sought to identify application and technology areas that can benefit from BELLA to support digital transformation and international collaboration. These areas include Artificial Intelligence and Machine Learning, Mobile (5G / 6G / OpenRAN), Blockchain, Cloud Computing, High Performance Computing (HPC), Cybersecurity tools and technologies, Virtual Research Environments (ex. virtual laboratories, simulators, science gateways, data repositories), and Quantum technologies.

The findings also revealed the perceived barriers to unlocking BELLA's potential in the short term. The lack of awareness of BELLA is the primary obstacle to maximise BELLA's potential. Budgetary constraints, especially in LAC, and technical limitations pose additional challenges that would require targeted strategies for financial assistance and technical support. Finally, the survey highlights European concerns regarding policy usage and security measures. Addressing these concerns through strategies tailored to different regional contexts is crucial for building trust and ensuring the smooth implementation of BELLA.

1. INTRODUCTION

The SPIDER survey aims to evaluate the current state of the digital ecosystem interconnectivity in Latin America and the Caribbean and Europe, in view of the exploitation of the full potential of BELLA to stimulate digital transformation. BELLA (Building the Europe Link with Latin America) Infrastructure provides the long-term high-capacity interconnectivity between GÉANT, in Europe, and RedCLARA, in Latin America and the Caribbean, interconnecting the National Research and Education Networks (NRENs) in both regions. Despite this interconnectivity, the BELLA potential hasn't been fully exploited.

The survey was conducted online using web-based tools and was available in English, Spanish, and Portuguese. The survey was answered by 357 people from Latin America and the Caribbean (284 responses) and Europe (73 responses), including representatives from NRENs, Universities, Research Performing Organisations (RPOs), Research Funding Organisations (RFOs), private organisations, government organisations, innovation hubs and NGOs.

Participation in the survey was voluntary and respondents could withdraw at any time. All responses were kept confidential and not disclosed to third parties. Data was used only in aggregated form to ensure anonymity. This approach ensured that individual comments could not be traced back to their originators, allowing for a comprehensive analysis of the digital ecosystem interconnectivity provided by the BELLA Infrastructure.

The report D2.1 is organised in four sections:

1. **Introduction:** The introduction outlines the objectives of the survey to evaluate the digital ecosystem interconnectivity in Latin America and the Caribbean and Europe.

2. **Survey Methodology:** This section details the scope and sample size of the survey, the design and dissemination of the online questionnaire, and the communication actions undertaken to promote survey participation.

3. **Survey Results:** This chapter provides an overview of the survey results. It comprises the profile of the respondent, including the region of the respondents, gender, organisation type, size and position, and EU-LAC collaboration relationships. It then examines specific questions related to the assessment of high-speed internet connectivity, knowledge and use of local NRENs, and BELLA's potential for digital transformation, including barriers for the use of BELLA. A final section of the survey includes qualitative insights from the respondents.

4. **Conclusion**: The conclusion chapter synthesises key findings, emphasising the critical role of high-speed internet connectivity and identifying regional disparities in NREN awareness and utilisation. Recommendations were included in this section.

2. SURVEY METHODOLOGY

2.1. Scope and Sample Size

The survey on the digital ecosystem interconnectivity in LAC and EU was sent to a sample size of more than 3.000 key actors from both regions. The questionnaire was distributed by email and through various online and public channels, including partners and multiplier networks, such as the RedCLARA website, the LAC network of National Contacts Points (NCPs), and various social media platforms. This approach was intended to reach a broad and varied target audience, encompassing a wide spectrum of participants from different backgrounds and from both regions, EU and LAC.

The nine partners involved in the project were encouraged to disseminate the survey through their respective networks, aiming to ensure a broad representation of views and perspectives on the digital ecosystem interconnectivity. This decentralized approach, while increasing reach, also contributed to the challenges in tracking the full extent of the survey's dissemination. The partners capitalised on their contacts and multiplier networks to encourage participation and gather insights from stakeholders relevant to the subject matter.

The survey was accessible from 3 April to 17 May 2024. During this period we gathered 357 responses from a wide range of participants, exceeding by 79% the initial goal of 200 responses.

2.2. Online Questionnaire

The survey comprised 26 questions formatted as open-ended, multiple-choice, and ranking questions that were organised in five sections (refer to Annex 1):

Section A - Basic Information.

Section B - Connectivity Requirements Assessment.

Section C - EU-LAC Interconnectivity.

Section D - Barriers to use the BELLA Network.

Section E - Suggestions and Feedback.

The survey was conducted on the online platform Survey Monkey. This tool provides a user-friendly interface, rapid response collection capabilities, and ease of data analysis. Survey Monkey is a recognized tool for optimising the distribution process, response gathering, and data visualisation.

To safeguard data privacy, comply with General Data Protection Regulations (GDPR), and ensure the anonymity of responses, several measures were implemented:

- Due to GDPR requirements, the individual lists of stakeholders invited to take the survey were not shared among partner organisations. Partner INMARK managed the survey administration and data analysis. Potentially identifiable response data, such as email addresses, were not shared with the consortium.

- Respondents were not asked to provide their names or specific personal information. To get an insight into the profile of the respondent, only general demographic questions were asked. Respondents could voluntarily provide their email addresses if they wished to know the final results of the survey.

- Only one administrator had access to the completed questionnaires.

- Frequent backups of responses were performed to avoid accidental data deletion.

- A privacy statement was included before the survey began to inform participants about data protection measures.

Participants were assured that their responses would be kept strictly confidential and not disclosed to any third parties. Data were used in aggregated form only, and individual comments were not attributed to their originators. Participation in the survey was voluntary, and respondents could leave the survey at any time.

Figure 1: Survey Privacy Statement

2.3. Communication Actions to Promote the Survey

To ensure broad participation and maximise the survey's reach, a specific communication strategy was implemented. This strategy utilised SPIDER's official channels, while partners also leveraged their networks to reach their contacts effectively.

Figure 2:Design to promote the survey

Official Channels of SPIDER

1. **Website**

- Article: A detailed article was created and featured on the SPIDER website, providing information about the survey's purpose, importance, and instructions for participation. This blog entry included a direct link to the survey, making it easily accessible to visitors.

- Pop-up Window: A pop-up window was added to the website, inviting each visitor to participate in the survey.

2. **Social Media**

SPIDER's social media platforms, including X (former Twitter) and LinkedIn, were actively used to promote the survey. Posts highlighted the survey's significance and its potential impact on the digital ecosystem interconnectivity. A series of scheduled posts ensured continuous promotion throughout the survey period.

3. **Newsletter**

The survey was featured in SPIDER's newsletter and distributed to a broad audience of 400 subscribers. The newsletter provided a concise overview of the survey, its goals, and the impact of the BELLA Infrastructure. It included a call-to-action with a direct link to the survey, urging subscribers to participate and share the survey within their networks.

Partner Network Distribution

Each partner organisation played a crucial role in promoting the survey by leveraging their respective networks. The following actions were taken:

1. **Project Partners´ Organisations**

SPIDER Partners distributed the survey information through their organisations to reach professionals not directly involved in the project but who are members of local NRENs, universities, private organisations, RPOs, RFOs, and more. This ensured that members within each organisation were aware of the survey and encouraged to participate.

2. **Online Communications**

Each partner used their external communication platforms, such as social media accounts, websites, and blogs, to promote the survey. They shared the SPIDER posts and created content tailored to their specific audiences, including posting updates and sharing the survey link with their followers.

3. **Direct Outreach**

Partners conducted direct outreach to key stakeholders and relevant contacts within their networks. Personalized emails and messages were sent to individuals and organisations likely to be interested in the survey. This direct approach helped to engage participants who might not have been reached through broader communication channels.

Through these coordinated communication actions and weekly updates, the survey received widespread visibility and engagement across various platforms and networks, ensuring robust participation and valuable insights into digital ecosystem interconnectivity.

Examples of these actions can be found in Annex 2.

3. SURVEY RESULTS

3.1. Profile of Survey Respondents

To gain a balanced perspective on the current state of the digital ecosystem interconnectivity between Latin America and the Caribbean and Europe, the survey aimed to obtain a convenient sample of responses from both regions. We received a total of 357 responses, of which 284 (79.55%) were from LAC participants, while 73 (20.45%) were from Europe. The higher number of responses from LAC suggests a more interest in the potential of BELLA infrastructure to support digital transformation.
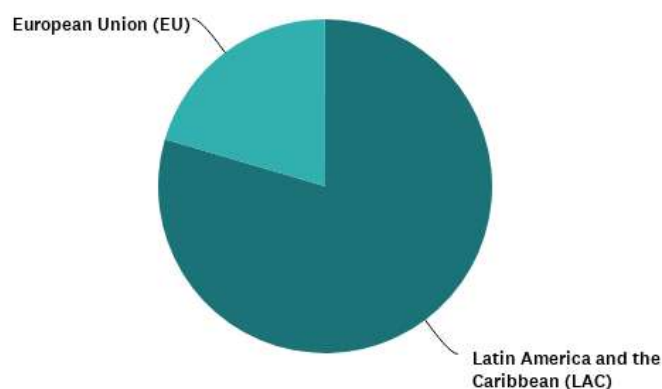
Figure 3:Survey Respondents by Region

Gender

Despite the survey being sent to a broad spectrum of stakeholders, both women, and men involved in the digital ecosystem of science, technology, education, and innovation, the results indicated a predominance of male respondents. Among the 357 responses received, 63.59% were from men, while women accounted for 35.85% of the responses, indicating a substantial women underrepresentation in the use of digital transformation technologies. In contrast, nonbinary individuals represented a negligible 0.56%.

Nonetheless, the higher participation of male respondents doesn't undercut the significance of the survey outcomes. It might underscore the interest and active involvement of men in shaping digital interconnectivity initiatives across these regions or the male representation within the targeted organisations of the survey.
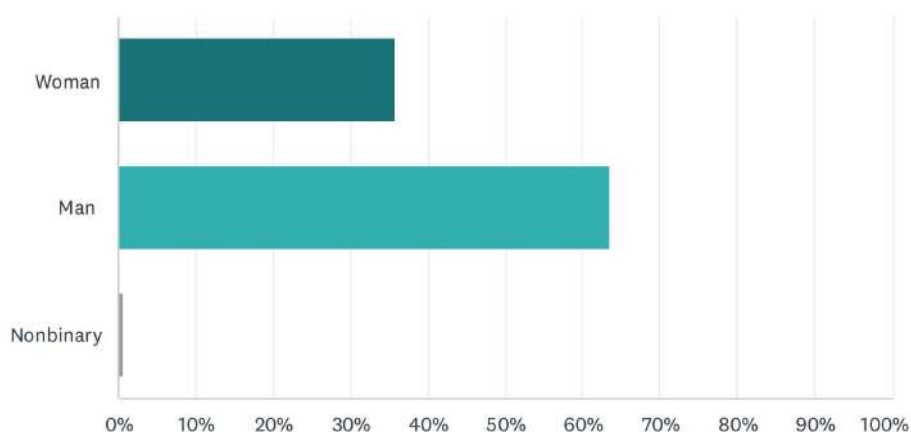
Figure 4:Survey Respondents by Gender

Organisation Type

From all the survey responses, most of the participants (60.51%) were from public universities (46.50%) and private universities (14.01%). Additionally, private organisations were represented by 8.40% of respondents, government organisations by 8.12%, and NRENs by 7,28%. The full distribution of responses is presented in the graph below, showing the representation of other organisations such as RFOs, RPOs, NGOs, and more:
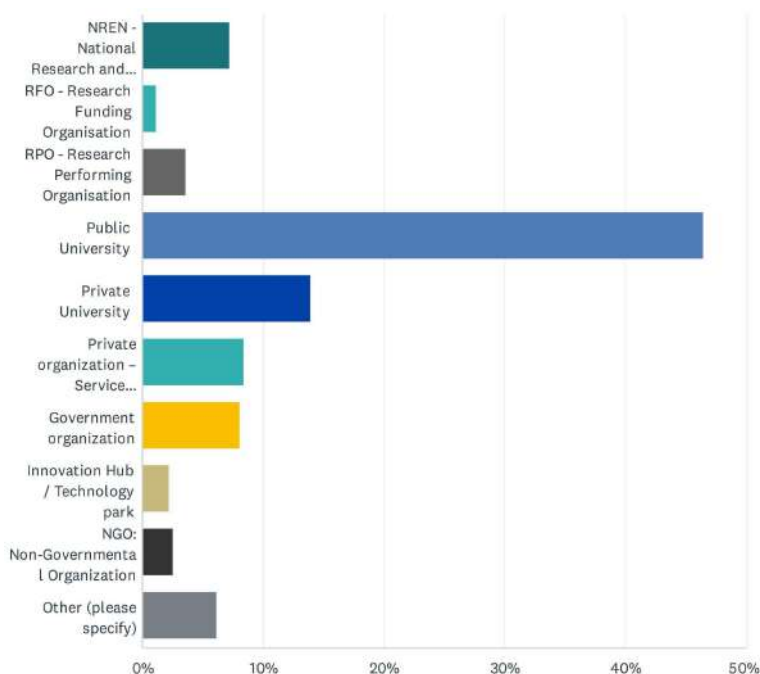
Figure 5:Survey Respondents by Organisation Type

This comprehensive overview underscores the breadth of participation from various sectors, ranging from academia and research to government agencies, private enterprises, and non-profit organisations.

Organisation Size

Also, to gain insights into the organisation's size, participants were asked about the number of employees in their organisations. The data shows that a majority of organisations participating in the survey are large, with more than 250 employees, accounting for 68.35%. Medium-sized organisations, with 11-50 employees and 51-250 employees, constitute 14.85%, and 10.36%, respectively. Lastly, small organisations, with fewer than 10 employees, make up only 6.44%.
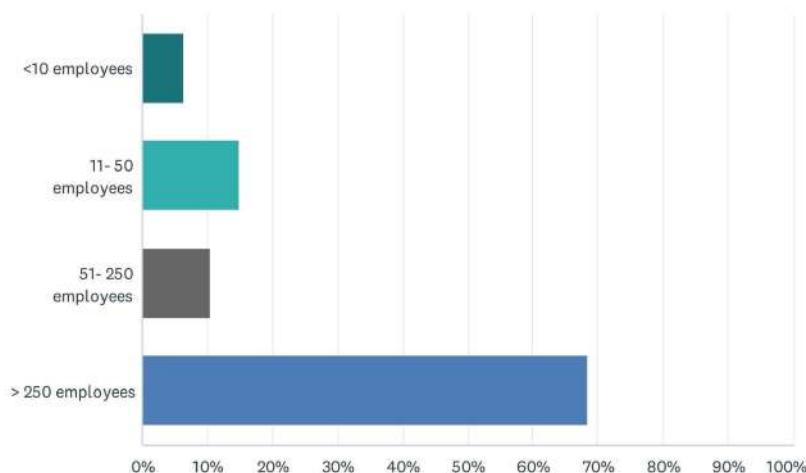
Figure 6:Size of the organisations participating in the survey

Position at Organisations

The survey shows a diverse range of roles among respondents. The largest group of respondents, comprising 25.94%, identified as IT personnel. Professors account for 17.74%, followed by researchers that represent 16.99%, which reflects a significant presence of academic professionals. Directors made up 14.55% of the respondents, while Managers constituted 13.13%, highlighting a considerable number of leadership roles. CEO, COO, and CFO positions were held by 7.46% of participants. Consultants represented the smallest group at 2.71%, demonstrating specialized advisory roles within organisations.
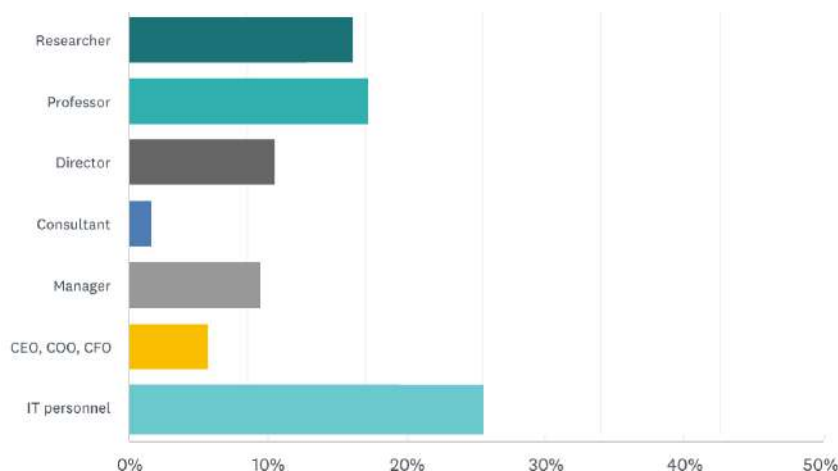
Figure 7:Survey Respondents by Position

Also, to better understand the profile of participants, and the extent of collaboration between organisations from the EU and Latin America and the Caribbean (LAC), we surveyed respondents about their current and planned partnerships.

Europe-LAC Collaboration
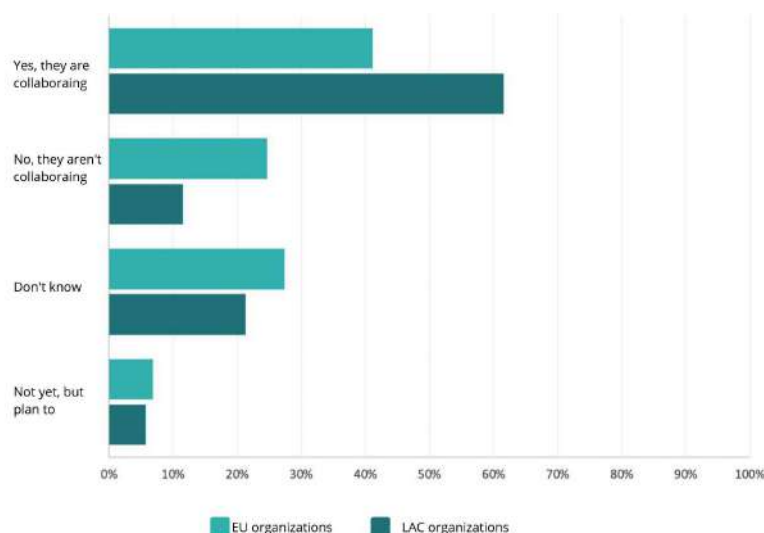
Figure 8:Collaboration between organisations from EU and LAC

Among LAC respondents, the majority (61.51%) confirmed existing collaborations with European organisations; another 11.51% said no; 21.22% were unsure; and 5.76% planned to collaborate in the future.

Similarly, 41.10% of European respondents confirmed collaborations with LAC; 24.66% reported no collaboration; 27.40% were unsure; and 6.85% planned to collaborate in the future.

These results indicate that while a majority of LAC organisations are already collaborating with European counterparts, fewer European organisations report the same. However, both regions show potential for increased collaboration in the future.

3.2. Assessment of Connectivity Requirements

3.2.1. Relevance of high-speed internet connection

As a crucial part of understanding the current state of the digital ecosystem, the survey inquired about the importance of high-speed internet connections for participants' activities.

We asked participants to assess the importance of a high-speed internet connection for daily activities on a scale from 1 (Not at all important) to 4 (Extremely important), with 2 (Moderately Important) and 3 (Important) as intermediate options.
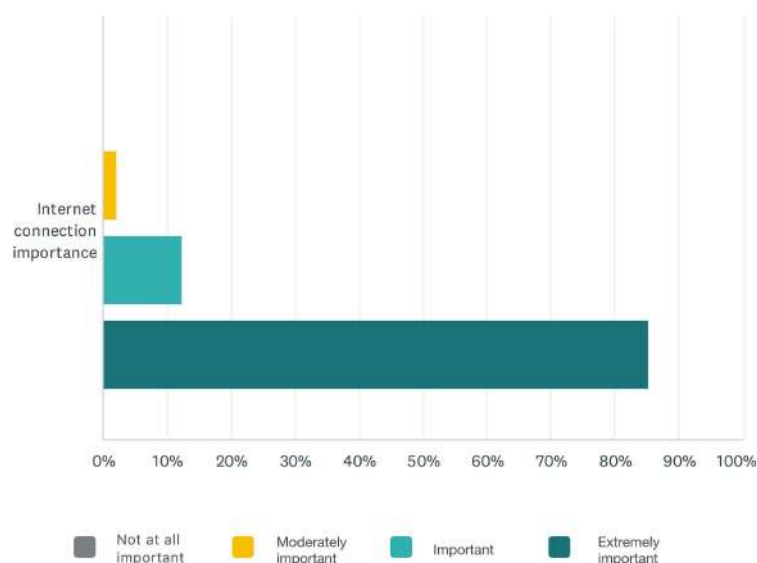
Figure 9:Importance of high-speed internet connection

The great majority of respondents, 85.20%, indicated that a high-speed internet connection is extremely important for their activities. This highlights the critical role of reliable internet in business and research operations. Another group of responders (12.39%) said that high-speed internet connection is important. Only a minimal number of respondents (0.30%) indicated that they could operate without the internet for a couple of days, emphasising the pervasive need for constant connectivity in today's digital environment.

Table 1: Importance of high-speed internet connection for daily activities

Region	Importance (average)
LAC	3.85
Europe	3.73
Total	3.82

When comparing both regions, the importance of high-speed internet connection for daily activities slightly varies. In the LAC region, the average rating stands at 3.85, while in Europe, it is slightly lower at 3.73. Nonetheless, both regions emphasize the crucial role of reliable internet in business and research operations, as evidenced by the combined average rating of 3.82.

3.2.2. Degree of satisfaction with current internet connectivity

On the other hand, when asked about the level of satisfaction with the current internet connectivity, the survey reveals a spectrum of satisfaction levels, ranging from very dissatisfied (1) to very satisfied (4), with 2 (Moderately dissatisfied) and 3 (Satisfied) as intermediate options.
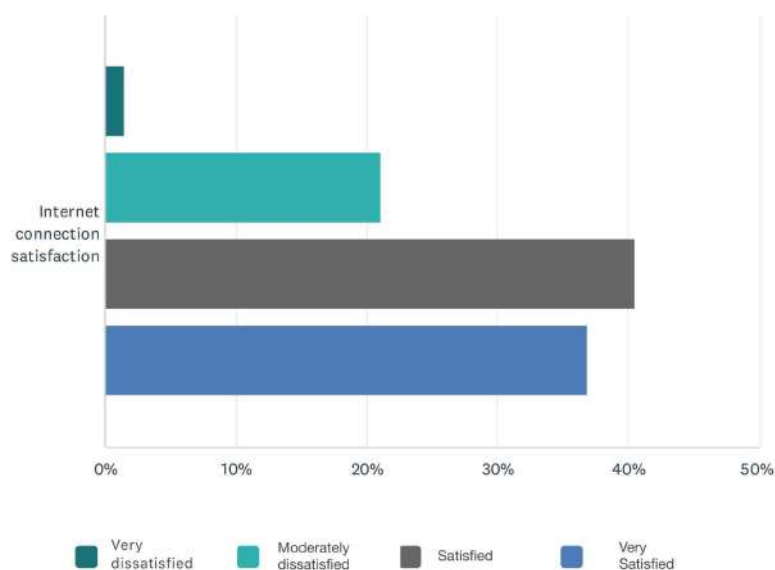
Figure 10:Internet connection satisfaction

The largest group (40.48%) reported feeling moderately satisfied, closely followed by a significant percentage (36.85%) expressing high satisfaction. Dissatisfaction is also notable, with 21.15% expressing discontent, while a smaller percentage (1.51%) reported feeling very dissatisfied with their current internet connectivity. Out of these dissatisfied respondents, 66.67% are from universities, and 12% from government organizations.

Overall, it can be appreciated that while a significant portion of respondents are content with their internet service, a notable percentage faces challenges that affect their productivity and efficiency.

Table 2: Satisfaction with internet connection by region

Region	Satisfaction (average)
LAC	3.02
Europe	3.52
Total	3.13

When comparing satisfaction levels with current internet connectivity between the two regions, Europe shows a higher average satisfaction rating of 3.52 compared to 3.02 in the LAC region. However, the combined average satisfaction rating for both regions stands at 3.13, indicating a generally positive perception of internet connectivity satisfaction.

3.2.3. Use of research infrastructures and computing resources

To further understand the technological needs and collaborative practices of organisations, participants were asked whether their organisation needs to make use of research infrastructures or computing resources (e.g., processing, storage, databases, etc.) that are remotely hosted by a research organisation or a cloud provider. The analysis of

respondents' answers regarding the need for remote access to research infrastructures or computing resources reveals a clear trend.
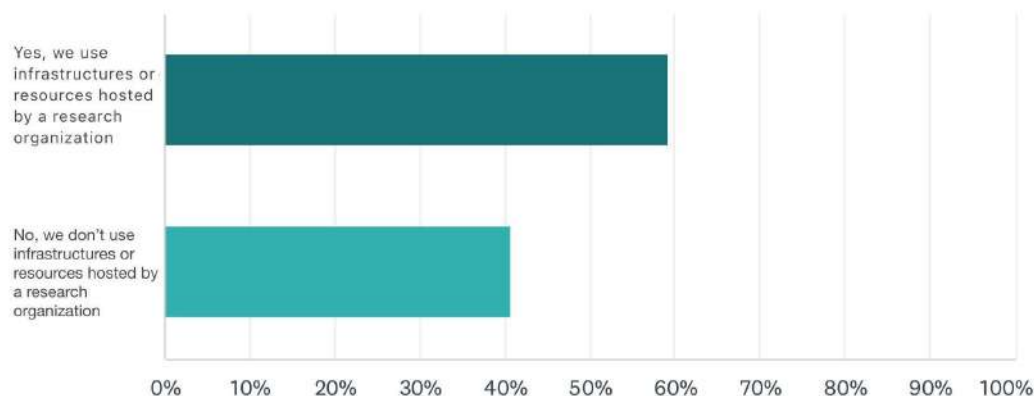

Figure 11: Use of research infrastructures or computing resources remotely hosted by a research organisation

A majority of respondents (59.21%) expressed the need for such resources, indicating a significant demand for remote access to research infrastructures or computing resources hosted by research organisations to support their activities. Among respondents who reported using research infrastructures or computing resources hosted remotely by research organisations, many cited institutions such as CERN in Switzerland, the REUNA network in Chile, and CEDIA in Ecuador. In addition, it's worth highlighting that 64.00% of dissatisfied respondents with their current internet connection, claimed to use infrastructures or computing resources remotely hosted by a research organisation.

On the contrary, 40.79% of respondents reported no need for remote access, suggesting that some organisations may already have sufficient in-house resources or alternative arrangements to meet their computing needs.

Now, on the other hand, when asked about the use of computing resources hosted by a cloud provider, responses show that a great majority (73.72%) expressed the need for such resources, indicating a strong reliance on cloud computing for various activities. This high percentage suggests that organisations recognize the benefits of cloud services, such as scalability, flexibility, and accessibility, in meeting their computing needs. Among the cloud providers most frequently mentioned are AWS (Amazon Web Services), GCP (Google Cloud Platform), Microsoft Azure (particularly in conjunction with Microsoft's suite of productivity tools like Office 365 and OneDrive), Google (including Google Drive and Google Suite), and Nextcloud.

Conversely, 26.28% of respondents reported no need for cloud computing services, which may indicate either a preference for on-premises solutions or existing investments in alternative computing infrastructures.
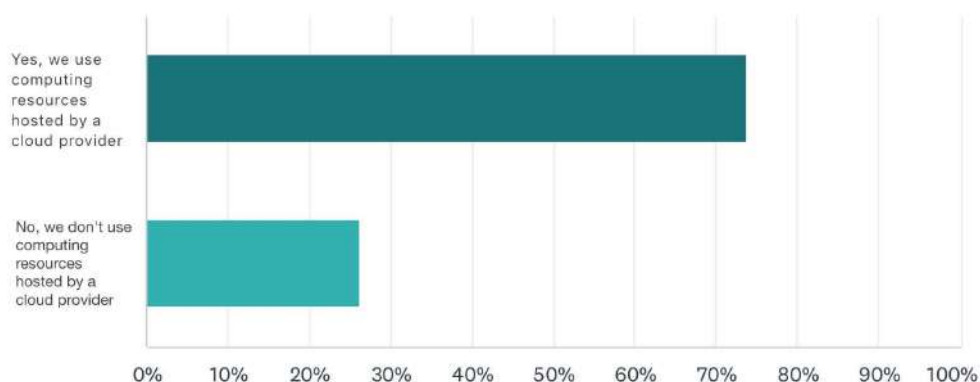
Figure 12:Use of computing resources hosted by a cloud provider

Overall, these findings underscore the growing importance of cloud computing in supporting organisational activities and highlight the need for organisations to carefully assess their computing requirements and infrastructure strategies in light of evolving technological trends.

Table 3:Use of research infrastructures or computing resources

Host	LAC	Europe	Total
Research organisation	62.31% (260)	47.89% (71)	59.21% (331)
Cloud provider	76.23% (244)	64.71% (68)	73.72% (312)

Note: The total number of answers is indicated in parentheses

The analysis of the hosting preferences among respondents reveals notable differences between LAC and Europe. The majority of respondents from LAC (62,31%) indicated the use of research infrastructures or computing resources hosted remotely by research organisations, compared with 47.89% in Europe.

In contrast, when it comes to utilising computing resources hosted by a cloud provider, respondents from both regions overwhelmingly favoured this option. In LAC, 76.23% of respondents preferred cloud providers, compared to 64.71% in Europe. This indicates a strong reliance on cloud computing services across both regions, with the LAC region showing a slightly higher preference for cloud providers compared to Europe.

Overall, these findings suggest that while research organisations remain a popular choice for hosting computing resources, there is a growing trend toward utilising cloud providers, particularly in the LAC region.

3.2.4. Applications and Services Providers

To further explore participants' usage patterns, they were asked about the applications or services they utilise and their providers, with options including NRENs, Telecommunications, and Small companies. Given the wide range of responses, data was organised by provider to facilitate comprehension and analysis, as illustrated below:
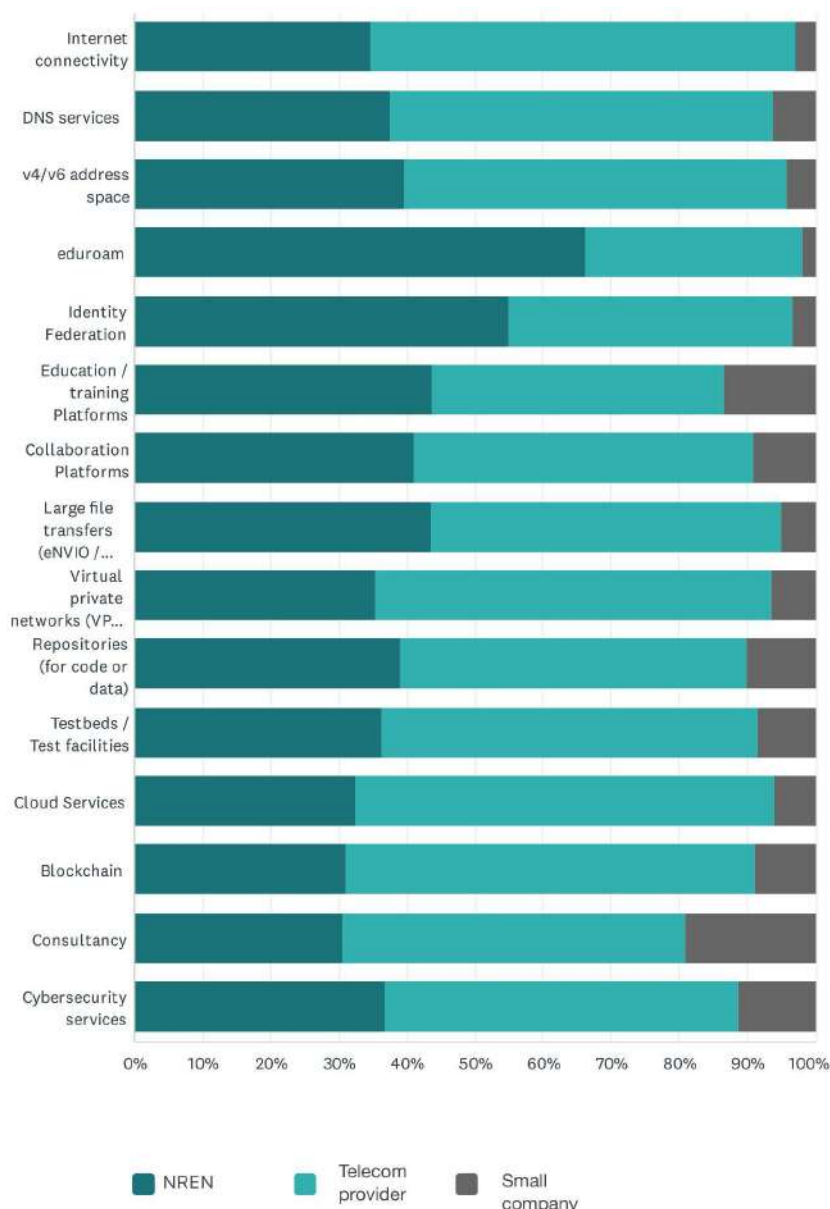
Figure 13:Applications and services providers

The analysis of participants' usage patterns across various applications and services and their providers reveals notable trends. For internet connectivity, Telecommunications providers emerge as the dominant choice, with 62.50% of respondents opting for this option, followed by NRENs at 34.68%, and Small companies at 2.82%. Similarly, Telecommunications providers lead in DNS services with 56.35%, while NRENs follow closely at 37.56%, and Small companies at 6.09%. However, when it comes to eduroam, a service prevalent in academic settings, NRENs take the lead with 66.25%, surpassing Telecommunications providers at 31.87%, and Small companies at 1.88%.

Across the responses, NRENs maintain a significant presence, particularly in services like Identity Federation, where they account for 54.92%, compared to 41.80% for Telecommunications providers, and 3.28% for Small companies.

Table 4: Applications and Services Providers

Applications or services	Provider			Total
	NRENs	Telecoms provider	Small company	
Internet connectivity	34.68%	62.50%	2.82%	100% (248)
DNS services	37.56%	56.35%	6.09%	100% (197)
v4/v6 address space	39.66%	56.32%	4.02%	100% (174)
eduroam	66.25%	31.87%	1.88%	100% (160)
Identity Federation	54.92%	41.80%	3.28%	100% (122)
Education / training Platforms	43.68%	43.10%	13.22%	100% (174)
Collaboration Platforms	41.01%	50.00%	8.99%	100% (178)
Large file transfers (eNVIO / FileTransfer / Filesender)	43.48%	51.55%	4.97%	100% (161)
Virtual private networks (VPN) / layer 2 VLANs	35.47%	58.14%	6.40%	100% (172)
Testbeds / Test facilities	39.13%	50.93%	9.94%	100% (161)
Repositories (for code or data)	36.44%	55.08%	8.47%	100% (118)
Cloud Services	32.43%	61.62%	5.95%	100% (185)
Blockchain	31.11%	60.00%	8.89%	100% (90)
Consultancy	30.58%	50.41%	19.01%	100% (121)
Cybersecurity services	36.88%	51.88%	11.25%	100% (160)

Note: The total number of answers is indicated in parentheses

Furthermore, Telecommunications providers dominate most service categories, such as internet connectivity, cloud services, blockchain, and virtual private networks, among others, reflecting their broad capabilities and resources. NRENs also play a significant role, particularly in services tailored to academic and research environments, such as eduroam and identity federation. Small companies contribute meaningfully to certain areas, such as education/training platforms, repositories, consultancy, and cybersecurity services, highlighting their niche capabilities and specialised offerings.

Table 5: Applications and Services Providers in LAC

Applications or services	Provider			Total
	NRENs	Telecoms provider	Small company	
Internet connectivity	29.90%	67.53%	2.58%	100% (194)
DNS services	32.90%	61.29%	5.81%	100%

Applications or services	Provider			Total
	NRENs	Telecoms provider	Small company	
				(155)
v4/v6 address space	33.81%	62.59%	3.60%	100% (139)
eduroam	61.16%	36.36%	2.48%	100% (121)
Identity Federation	50.00%	46.88%	3.13%	100% (96)
Education/training Platforms	40.44%	47.79%	11.76%	100% (136)
Collaboration Platforms	38.57%	52.86%	8.57%	100% (140)
Large file transfers (eNVIO / FileTransfer / Filesender)	39.37%	56.69%	3.94%	100% (127)
Virtual private networks (VPN) / layer 2 VLANs	31.65%	61.87%	6.47%	100% (139)
Testbeds / Test facilities	32.29%	60.42%	7.29%	100% (96)
Repositories (for code or data)	33.83%	54.89%	11.28%	100% (133)
Cloud Services	27.59%	65.52%	6.90%	100% (145)
Blockchain	28.57%	62.34%	9.09%	100% (77)
Consultancy	29.00%	54.00%	17.00%	100% (100)
Cybersecurity services	32.56%	58.14%	9.30%	100% (129)

Note: The total number of answers is indicated in parentheses

As well as in the overall analysis, the responses from LAC also reveal that Telecommunications providers dominate most services, particularly internet connectivity (67.53%), DNS services (61.29%), v4/v6 address space (62.59%), virtual private networks (61.87%), testbeds / test facilities (60.42%), cloud services (65.52%) and blockchain (62.34%). NRENs also play a significant role, especially in eduroam (61.16%), Identity Federation (50.00%), and large file transfers (39.37%).

On the other hand, small companies have a smaller yet notable presence, particularly in consultancy (17.00%) and education/training platforms (11.76%).

Overall, Telecommunications providers lead in general connectivity and cloud services, while NRENs are crucial for research and education services. Small companies, although less dominant, contribute significantly to specific areas.

Table 6: Applications and Services Providers in Europe

Applications or services	Provider			
	NRENs	**Telecoms provider**	**Small company**	**Total**
Internet connectivity	51.85%	44.44%	3.70%	100% (54)
DNS services	54.76%	38.10%	7.14%	100% (42)
v4/v6 address space	62.86%	31.43%	5.71%	100% (35)
eduroam	82.05%	17.95%	0.00%	100% (39)
Identity Federation	73.08%	23.08%	3.85%	100% (26)
Education/training Platforms	55.26%	26.32%	18.42%	100% (38)
Collaboration Platforms	50.00%	39.47%	10.53%	100% (38)
Large file transfers (eNVIO / FileTransfer / Filesender)	58.82%	32.35%	8.82%	100% (34)
Virtual private networks (VPN) / layer 2 VLANs	51.52%	42.42%	6.06%	100% (33)
Testbeds / Test facilities	54.55%	31.82%	13.64%	100% (22)
Repositories (for code or data)	64.29%	32.14%	3.57%	100% (28)
Cloud Services	50.00%	47.50%	2.50%	100% (40)
Blockchain	46.15%	46.15%	7.69%	100% (13)
Consultancy	38.10%	33.33%	28.57%	100% (21)
Cybersecurity services	54.84%	25.81%	19.35%	100% (31)

Note: The total number of answers is indicated in parentheses

The analysis of European respondents shows a different pattern compared with Latin America. In Europe NRENs are the predominant provider of several key services, especially eduroam (82.05%), v4/v6 address space (62.86%), Identity Federation (73.08%), and repositories (64.29%). Telecommunication providers are significant in cloud services (47.50%), internet connectivity (44.44%), and DNS services (38.10%). Lastly, small companies have a notable presence in consultancy (28.57%) and education/training platforms (18.42%).

Overall, in Europe, NRENs dominate research and education services, while Telecommunications providers lead in general connectivity and cloud services. Small companies, though less prevalent, play important roles in specific areas.

Breakdown Between Europe and Latin America and the Caribbean

The analysis reveals both similarities and differences between Europe and LAC in digital ecosystem engagement, internet connectivity, satisfaction levels, and service provider preferences. These insights underscore the importance of tailored strategies to enhance digital infrastructure and foster inclusive participation across both regions because although significant similarities are found, the differences remain a relevant factor to consider.

Similarities

Both Europe and LAC exhibit a strong recognition of the critical importance of high-speed internet connectivity, with both regions assigning it high-importance ratings. This indicates a shared understanding of the fundamental role of reliable internet access in supporting business and research activities. Continuously, both regions also face some degree of dissatisfaction with current internet services, with notable percentages expressing discontent (LAC: 21.15%, Europe: 18.00%), suggesting a universal need for service improvements to enhance productivity and efficiency.

Also, there is a substantial demand for cloud computing resources in both regions, underscoring a global trend towards leveraging cloud services for their scalability and flexibility. LAC demonstrates a higher preference for cloud computing providers (76.23%) compared to Europe (64.71%), indicating a strong reliance on cloud solutions to meet organisational needs. Both regions also express a need for remote access to research infrastructures or computing resources hosted by research organisations, highlighting the critical role of the digital infrastructure in supporting organisational activities across sectors.

Differences

Regarding preferred service providers, the LAC region relies on telecommunications companies for general connectivity, DNS services, v4/v6 address space, virtual private networks, cloud services, and blockchain. Europe demonstrates a stronger reliance on NRENs for specialized services like eduroam (82.05%) and Identity Federation (73.08%), compared to LAC where NRENs also play significant roles but with slightly less dominance. This difference in service provider preference reflects varying regional infrastructure investments tailored to support academic and research sectors effectively.

These differences underscore the importance of region-specific approaches in addressing digital infrastructure needs, engagement disparities, and service provider preferences to enhance overall connectivity, productivity, and collaboration within each region.

Findings on Connectivity Requirements for business and research activities

- A significant majority of respondents (85.20%) rated high-speed internet as extremely important for their activities. This underscores the **critical role that reliable and fast internet connections** play in both business and research operations, and thus in digital transformation.

- While many respondents are satisfied with their internet service, the LAC region shows a lower average satisfaction rating than Europe. Overall, the data underscores the **importance of continuous efforts to enhance digital infrastructure** and address varying satisfaction levels across regions.

- The majority of respondents who are dissatisfied with their current internet connectivity are from universities and government organisations. Also, 64.00% of these dissatisfied participants claim to use research infrastructures or computing resources remotely hosted by a research organisation.

- Responses highlight the **evolving landscape of computing resources**, with a notable **shift towards cloud providers**, particularly in the LAC region, while still maintaining a strong reliance on traditional research infrastructure hosts.

- **Telecommunications providers dominate** the general connectivity and cloud services, yet NRENs play a critical role in academic and research services. Despite being less prevalent, small companies contribute significantly to niche areas, notably in Europe. This diversity highlights the **necessity for tailored strategies to address regional and sector-specific needs**, thereby strengthening the overall efficiency and resilience of the digital ecosystem.

3.3. EU-LAC Interconnectivity

This section analyses the long-term high-capacity interconnectivity provided by BELLA through GÉANT in Europe and RedCLARA in Latin America and the Caribbean, interconnecting the National Research and Education Networks (NRENs) of the two regions.

3.3.1. Knowledge of local NRENs

Understanding the level of familiarity with local National Research and Education Networks (NRENs) among respondents is crucial for assessing the knowledge of BELLA and the awareness and engagement of stakeholders within the digital ecosystem. The analysis of responses to the question on familiarity with local NRENs provides insights into the extent to which individuals are acquainted with the services and functions provided by these entities. By examining the distribution of responses across different familiarity levels, we gain valuable perspectives on the awareness levels and potential areas for improvement in engaging stakeholders with NREN services and initiatives.
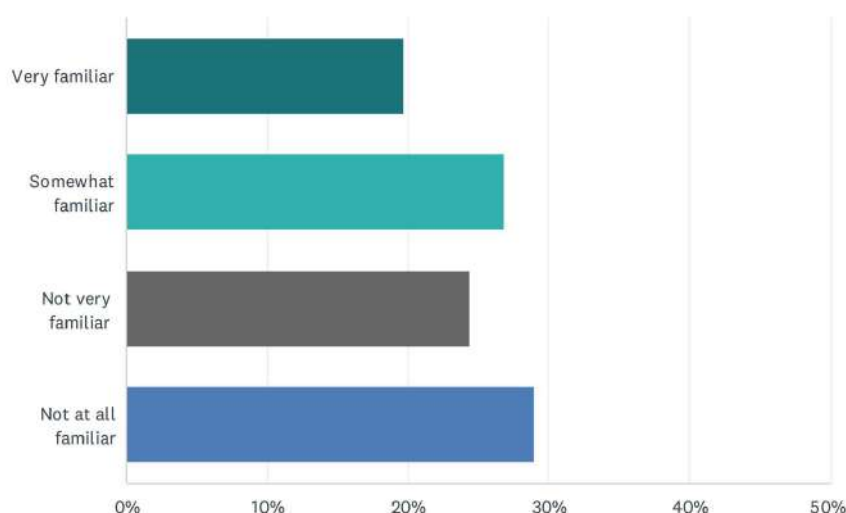

Figure 14: Familiarity with local NRENs

The analysis of respondents' familiarity with their local NREN reveals diverse levels of knowledge. While 19.75% claim to be very familiar, and 26.89% feel somewhat familiar, most of the respondents (53.36%) express limited or no familiarity. Specifically, 24.37%

indicate not very familiar, and 28.99% report not at all familiar. This indicates a range of understanding and awareness regarding the roles and services provided by local NRENs among respondents, with a majority indicating limited familiarity.

Table 7: Familiarity with local NRENs by Region

Region	Very familiar	Somewhat familiar	Not very familiar	Not at all familiar	Total
LAC	19.02%	28.26%	24.46%	28.26%	100% (184)
Europe	22.22%	22.22%	24.07%	31.48%	100% (54)
Total	19.75%	26.89%	24.37%	28.99%	100% (238)

Note: The total number of answers is indicated in parentheses

The analysis of familiarity with local NRENs across regions reveals slight differences in respondents' awareness levels. In LAC, the answer distribution highlights that while a moderate proportion of respondents are somewhat familiar with their local NREN (28.26%), an equally significant percentage (28.26%) have no familiarity at all. Additionally, 24.46% indicate limited familiarity, and 19.02% are very familiar with their local NREN. These findings underscore a wide spectrum of knowledge levels regarding local NRENs among respondents in the LAC region, highlighting that those with no or low levels of familiarity form a slight majority.

In Europe, the largest representation falls into the "Not at all familiar" category (31.48%), followed by "Not very familiar" (24.07%). This indicates that a significant 55.55% of respondents have little to no knowledge of their local NREN. Although the "Very familiar" and "Somewhat familiar" categories each account for 22.22% of respondents, they do not constitute the majority.

Thus, the results show that there is a slightly different level of NREN awareness between the two regions. Although LAC respondents generally showed more familiarity with their local NRENs compared to their European counterparts, this has not been reflected in higher use of NRENs as services providers in the region.

3.3.2. Current use of connectivity provided by local NRENs

Assessing the extent to which organisations utilise connectivity provided by their local NRENs is fundamental for understanding the integration of these networks into the digital infrastructure landscape.

The analysis of responses to the question on the use of connectivity provided by local NRENs offers insights into the level of reliance and engagement with NREN services among respondents. With response options ranging from "Always" to "Never," and considering that there are not currently NRENs in all countries, this analysis offers valuable perspectives on the utilisation patterns and challenges faced by organisations regarding NREN connectivity.
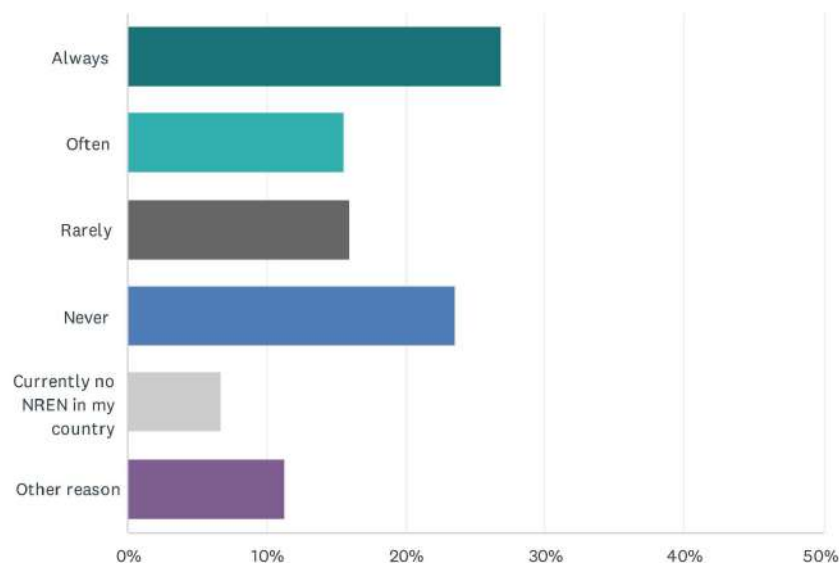
Figure 15: Use of connectivity provided by local NRENs

The data indicates mixed usage levels of NRENs among respondents. While a substantial portion always or often utilizes their local NREN (42.44% combined), a significant minority rarely or never does (39.50% combined). Some respondents also face barriers like the absence of an NREN in their country (6.72%) or other unspecified reasons (11.34%) for not using these networks.

Table 8: Regional comparison of the use of connectivity facilitated by local NRENs

Region	Always	Often	Rarely	Never	No local NREN	Other reason to not use	Total
LAC	22.83%	16.30%	17.93%	22.83%	8.15%	11.96%	100% (184)
Europe	40.74%	12.96%	9.26%	25.93%	1.85%	9.26%	100% (54)
Total	26.89%	15.55%	15.97%	23.53%	6.72%	11.34%	100% (238)

Note: The total number of answers is indicated in parentheses

The analysis of the extent to which organisations utilize connectivity provided by their local NRENs reveals notable differences between regions. In Europe, the most significant representation lies in the "Always" category (40.74%), indicating a high level of reliance on NREN connectivity among respondents in this region. This contrasts with the distribution in LAC, where a smaller percentage report "Always" (22.83%), suggesting a comparatively lower utilisation of NREN services.

Additionally, in both regions a substantial portion of respondents report "Never" (22.83% in LAC and 25.93% in EU), indicating a significant number of organisations that do not use local NREN connectivity.

Overall, while Europe demonstrates higher reliance on NREN connectivity, LAC exhibits greater variability in utilisation patterns, with a notable percentage of organisations reporting minimal or no use of local NREN services.

3.3.3. Plan to use connectivity provided by local NRENs

Next, participants were asked whether their organisation planned to utilize connectivity provided by their local NREN in the next two years, and the answers were distributed in the following way:
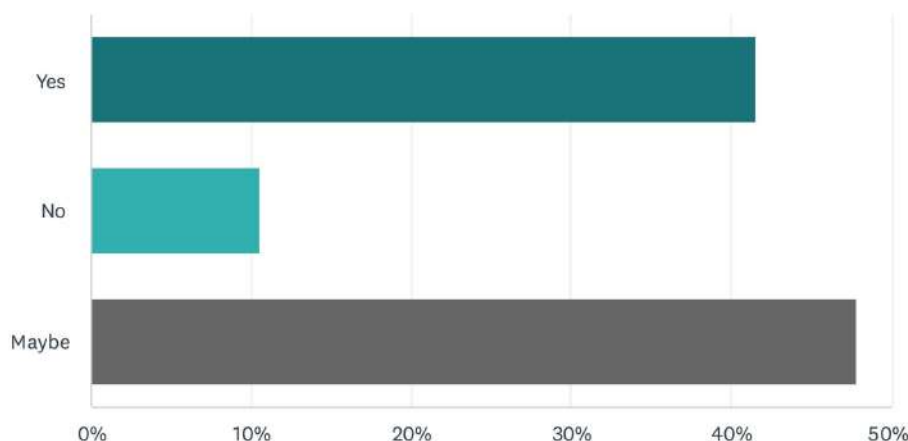

Figure 16: Willingness to use connectivity provided by local NRENs

The analysis of organisations' plans to utilise connectivity provided by their local NRENs within the next two years reveals a significant percentage of respondents indicating uncertainty. The most substantial representation lies in the "Maybe" category (47.90%), indicating that a large portion of organisations are considering but not yet committed to using local NREN connectivity. Meanwhile, a notable group revealed affirmative intentions, with 41.60% responding "Yes" to planning to use local NREN connectivity, indicating a considerable interest in leveraging these services shortly. Conversely, a smaller proportion (10.50%) responded "No," indicating a definite lack of intention to utilise local NREN connectivity within the specified timeframe.

Overall, while there is significant interest and potential for increased the utilisation of NREN services, there remains a degree of uncertainty among organisations regarding their plans.

Table 9: Willingness to use connectivity provided by local NRENs by Region

Region	Yes	No	Maybe	Total
LAC	40.22%	8.15%	51.63%	100% (184)
Europe	46.30%	18.52%	35.19%	100% (54)
Total	41.60%	10.50%	47.90%	100% (238)

Note: The total number of answers is indicated in parentheses

In comparing the readiness of organisations to utilise connectivity provided by their local NRENs across regions, discernible differences arise. Specifically, in Europe, a greater percentage of organisations express a definite intention to adopt local NREN connectivity within the next two years, with 46.30% indicating affirmative plans. Conversely, in LAC,

while still substantial, the percentage of organisations intending to utilise local NREN connectivity is slightly lower at 40.22%.

Notably, the uncertainty regarding future NREN utilisation is more pronounced among LAC organisations, with 51.63% indicating a "Maybe" response compared to 35.19% in Europe. This suggests a higher degree of caution or deliberation among LAC respondents in formulating their plans for utilising NREN services.

Breakdown Between Europe and Latin America and the Caribbean

The findings on connectivity through local NRENs emphasise the importance of customising strategies for each region to enhance familiarity, tackle adoption barriers, and promote the effective use of NREN connectivity. While global responses show a certain degree of familiarity and use of NREN connectivity, the pronounced disparities concerning familiarity, utilisation, and future adoption plans for NRENs stand out.

Similarities

Europe and LAC share a common challenge of the level of awareness regarding their local NRENs. In Europe, 55.55% of respondents are categorised as "Not very familiar" or "Not at all familiar" with their NREN, while in LAC, this figure is slightly lower at 52.72%. These findings highlight a significant need to increase knowledge and understanding of NRENs among respondents in both regions.

Differences

There is a significant disparity in the utilisation of connectivity provided by local NRENs. In LAC, 39.13% of organisations report using NREN connectivity either "Always" (22.83%) or "Often" (16.30%). In contrast, Europe shows a higher utilisation rate with 53.70% of organisations using NREN connectivity, consisting of 40.74% "Always" and 12.96% "Often". This indicates a greater reliance on NREN services among EU organisations compared to those in LAC, reflecting potential differences in infrastructure maturity and integration of NREN capabilities into organisational operations.

Regarding future adoption plans, Europe shows higher readiness, with 46.30% intending to utilize local NRENs compared to 40.22% in LAC. Moreover, LAC exhibits greater uncertainty, with 51.63% expressing a "Maybe" response compared to 35.19% in Europe, indicating a higher degree of deliberation in decision-making regarding NREN adoption.

These differences indicate a need for targeted strategies to enhance the use of NREN connectivity and promote the benefits of NRENs effectively across diverse organisational landscapes.

Findings on EU-LAC interconnectivity through local NRENs

- The **similarity in the awareness challenge regarding local NRENs** between Europe and LAC underscores a significant need to enhance knowledge and understanding of these networks across both regions.

- The survey highlights **varying levels of NREN connectivity utilisation** between regions. Despite the level of knowledge in LAC, the utilisation of connectivity provided by local NRENs is lower in LAC region where 39,14% said that they use NRENs always or often, compared to 53,7% in Europe.

- Similarly, there is a significant group of respondents (39.50%) that recognise that they rarely or never utilise local NRENs services.

- The analysis of organisations' plans to utilise connectivity provided by their local NRENs within the next two years reveals a **notable degree of uncertainty among respondents.** While 41.60% of respondents showed substantial interest in leveraging NREN capabilities shortly, almost the majority of organisations

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expressed a "Maybe" stance (47.90%), reaching 51,63% in LAC. This indicates that a significant proportion of respondents is considering but not yet committed to using NREN connectivity.

3.4. BELLA potential for digital transformation

3.4.1. BELLA benefits for international collaboration

To gain deeper insights into the perceived advantages of BELLA, participants were asked to evaluate how this infrastructure can benefit their collaboration activities across various application areas. Respondents were required to select at least one benefit from a list of potential advantages, and the results were the following:
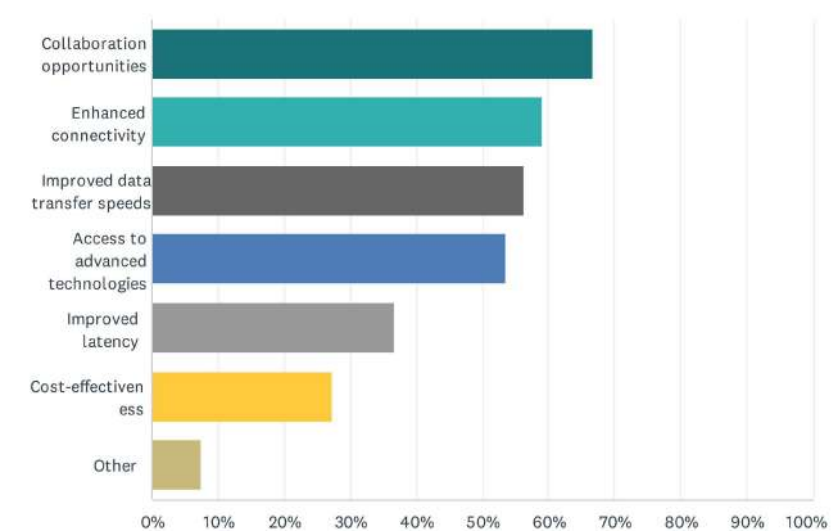
Figure 17: Benefits of BELLA for Collaboration Activities

The responses highlight several key areas where participants believe BELLA can enhance their collaborative activities. "Collaboration opportunities" was the most frequently cited benefit, with 66.67% acknowledging its potential. "Enhanced connectivity" and "Improved data transfer speeds" were also significant, selected by 59.15% and 56.34%, respectively. "Access to advanced technologies" was noted by 53.52%, while "Improved latency" was considered beneficial by 36.62%. "Cost-effectiveness" was identified as a benefit by 27.23%. Additionally, 7.51% specified other benefits, such as: the application of a same scheme for data and metadata protection, and local cluster connections.

Therefore, the data suggests that BELLA is a valuable initiative for fostering collaboration through enhanced connectivity, improved data transfer speed, and access to advanced technologies.

Table 10: Benefits of BELLA for Collaboration Activities by Region

Application Area	LAC	Europe	Total
Enhanced connectivity	62.05%	48.94%	59.15%
Improved data transfer speeds	59.04%	46.81%	56.34%
Improved latency	37.95%	31.91%	36.62%
Collaboration opportunities	68,67%	59.57%	66.67%
Cost-effectiveness	28.31%	23.40%	27.23%
Access to advanced technologies	58.43%	36.17%	53.52%
Other	6.02%	12.77%	7.51%
Total	100% (166)	100% (47)	100% (213)

The analysis of responses regarding the potential benefits of the BELLA infrastructure in collaboration activities across different application areas reveals notable trends and variations between regions.

In both LAC and Europe, "Collaboration opportunities" emerge as the most widely recognized potential benefit, with 68.67% and 59.57% of respondents, respectively. This indicates a strong consensus across regions regarding the perceived value of BELLA in fostering collaboration opportunities.

Additionally, "Enhanced connectivity" and "Improved data transfer speeds" are recognized as key benefits in both regions, with considerable percentages of respondents acknowledging their importance. However, LAC respondents show higher recognition of these benefits compared to their European counterparts. Contrarily, "Access to advanced technologies" is more prominently recognized as a potential benefit by LAC respondents (58.43%) compared to European respondents (36.17%).

This suggests a greater appreciation for the technological advancements facilitated by the BELLA infrastructure among LAC participants. While there are variations in the perceived benefits across regions, there is a consensus regarding the potential of the BELLA project to enhance collaboration activities, improve connectivity and data transfer speeds, and provide access to advanced technologies, with nuances in emphasis between LAC and European respondents.

3.4.2. Technology areas enhanced by the use of BELLA

Furthermore, participants were also asked to identify the most important technology areas that support digital transformation and could benefit from using BELLA. Addressing this question is imperative to recognize the pivotal role of technology in driving digital transformation across various sectors. This question was intended to garner insights into the specific technology domains perceived as essential for supporting digital transformation efforts and how the BELLA infrastructure can contribute to their advancement.

The following graph illustrates the relevance of technological areas addressed by SPIDER: Artificial Intelligence and Machine Learning, Mobile (5G / 6G / OpenRAN), Blockchain, Cloud Computing, High Performance Computing (HPC), Cybersecurity tools and technologies, Virtual Research Environments (ex. virtual laboratories, simulators, science gateways, data repositories), and Quantum technologies.
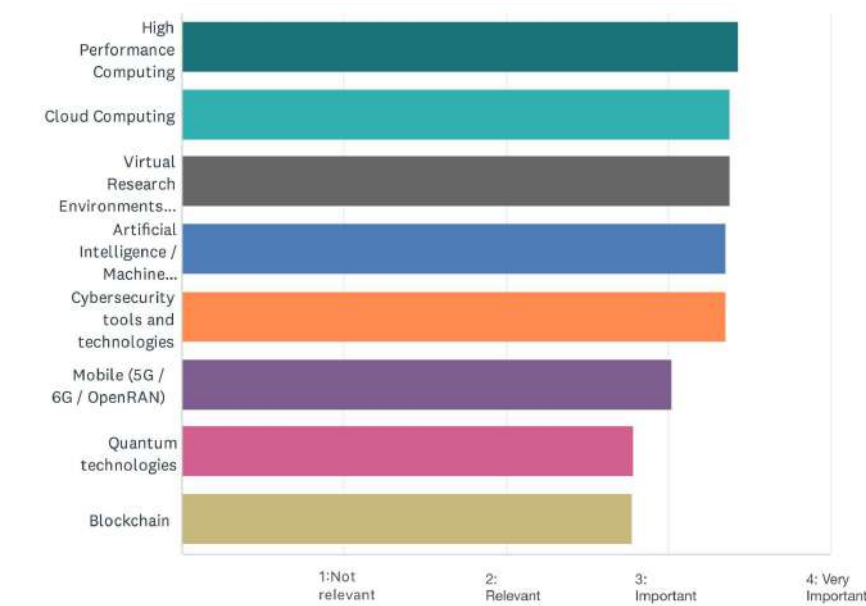
Figure 18: Relevance of technological areas for BELLA (average)

The survey results indicate a strong consensus regarding the importance of several technology areas crucial for digital transformation and benefiting from BELLA infrastructure. High-Performance Computing (average score: 3.44), Cloud Computing (average score: 3.39), and Virtual Research Environments (average score: 3.39) are highlighted as top priorities, reflecting their critical roles in data processing, scalable infrastructure, and collaborative research environments. Artificial Intelligence and Machine Learning also received significant support (average score: 3.36), underscoring their pivotal role in advancing digital capabilities. Similarly, Cybersecurity tools and technologies are highly regarded (average score: 3.36) for safeguarding digital assets and infrastructure. Below, the same results were translated into a chart representing the answers in percentages to facilitate understanding and distribution of the preferences.

Table 11: Relevance of technological areas for BELLA

Technological areas	Not Relevant	Relevant	Important	Very important	Total
Artificial Intelligence / Machine Learning	3.00%	11.00%	33.00%	53.00%	100,00% (200)
Mobile (5G / 6G / OpenRAN)	6.08%	21.55%	35.91%	36.46%	100,00% (181)
Blockchain	11.38%	26.95%	33.53%	28.14%	100,00% (167)
Cloud Computing	3.13%	10.94%	29.69%	56.25%	100,00% (192)
High-Performance Computing	3.16%	9.47%	27.37%	60.00%	100,00% (190)
Cybersecurity tools and technologies	4.71%	10.47%	29.32%	55.50%	100,00% (191)
Virtual Research Environments (ex. virtual laboratories, simulators, science gateways,	4.10%	9.23%	29.74%	56.92%	100,00% (195)

data repositories)					
Quantum technologies	10.92%	26.44%	35.63%	27.01%	100,00% (174)

Note: The total number of answers is indicated in parentheses

Among the surveyed areas, "High-Performance Computing" emerges as highly significant, with 60.00% of respondents rating it as "Very important." This indicates a strong acknowledgment of the critical role of HPC in advancing digital transformation efforts. Similarly, "Artificial Intelligence / Machine Learning" and "Cloud Computing" are deemed very important by over half of the respondents, underscoring their crucial role in supporting digital transformation initiatives.

Additionally, "Cybersecurity tools and technologies" and "Virtual Research Environments" are also recognized as highly important, with significant percentages rating them as very important. Conversely, "Quantum technologies" and "Blockchain" are perceived as less critical, with fewer respondents rating them as very important compared to other technological areas.

Overall, the data highlights the varying degrees of importance assigned to different technological areas, providing valuable insights into the areas that organisations prioritise for digital transformation initiatives supported by BELLA. These insights also underline the need for robust computing and connectivity solutions to drive advancements.

Table 12: Relevance of technological areas by region (average)

Areas	LAC	Europe	Total
Artificial Intelligence / Machine Learning	3.4	2.8	3.36
Mobile (5G / 6G / OpenRAN)	3.11	2.76	3.03
Blockchain	2.87	2.49	2.78
Cloud Computing	3.44	3.21	3.39
High-Performance Computing	3.47	3.35	3.44
Cybersecurity tools and technologies	3.47	2.95	3.36
Virtual Research Environments (ex. virtual laboratories, simulators, science gateways, data repositories)	3.45	3.19	3.39
Quantum technologies	2.86	2.54	2.79

In general, both LAC and Europe exhibit similar perceptions regarding the relevance of these areas, with some variations. "High-Performance Computing" emerges as the most relevant area in both regions, with relatively high average ratings of 3.47 in LAC and 3.35 in Europe. This indicates a shared recognition of the importance of high-performance computing across both regions.

Similarly, "Cloud Computing" and "Virtual Research Environments" receive high average ratings in both regions, suggesting their significant role in supporting digital transformation efforts.

However, there are some regional differences in perceptions of other technological areas. For instance, LAC tends to rate "Artificial Intelligence / Machine Learning," "Cybersecurity tools and technologies," and "Mobile (5G / 6G / OpenRAN)" slightly higher than Europe, indicating a potentially greater emphasis on these areas. Conversely, Europe tends to rate "Blockchain" and "Quantum technologies" slightly lower than LAC.

3.4.3 Barriers to use the BELLA Network

Lastly, to understand the challenges faced by organisations in utilising BELLA through their local NRENs, participants were asked to identify the main barriers or reasons preventing its use. This question aimed to uncover the obstacles that need to be addressed to enhance BELLA's adoption.
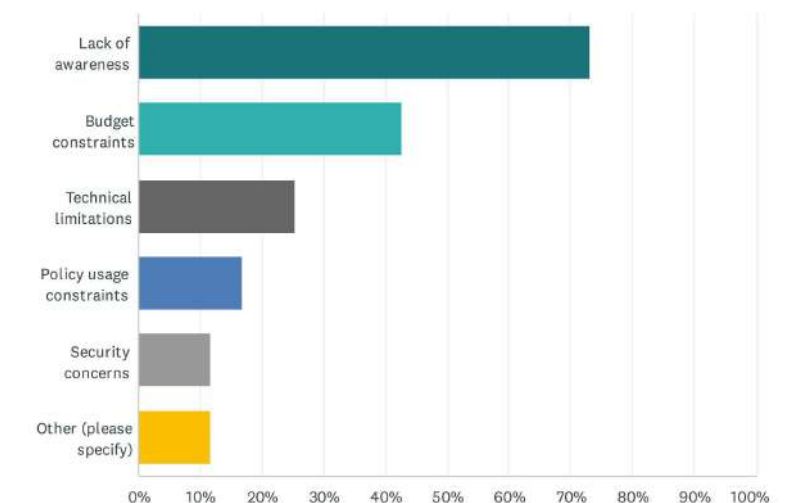
Figure 19:Barriers or reasons preventing the use of BELLA

The findings highlight several significant barriers to the use of BELLA, with lack of awareness emerging as the foremost challenge, cited by 73.24% of respondents. Budget constraints also loom large as a major concern, with 42.72% of respondents grappling with financial limitations.

Additionally, 25.35% of participants identified technical limitations, indicating potential infrastructure or capability gaps. Policy usage constraints affected 16.90% of respondents, while security concerns were raised by 11.74%.

Furthermore, 11.74% cited other reasons, including challenges such as a shortage of trained personnel in cybersecurity, limited staffing, lack of projects or initiatives leveraging BELLA, geographical digital disparities, and bureaucratic hurdles.

Table 13: Barriers or reasons preventing the use of BELLA by region

Barrier	LAC	Europe	Total
Lack of awareness	77.11%	59.57%	73.24%
Technical limitations	28.31%	14.89%	25.35%
Budget constraints	48.80%	21.28%	42.72%
Security concerns	9.04%	21.28%	11.74%
Policy usage constraints	15.06%	23.40%	16.90%
Other	9.04%	21.28%	11.74%
Total	100% (166)	100% (47)	100% (213)

Regionally, disparities in perceived barriers to adopting BELLA are evident. In LAC, 77.11% cite lack of awareness as a major obstacle, compared to 59.57% in Europe. Budget constraints are also more pronounced in LAC (48.80%) compared to Europe (21.28%). Conversely, Europe expresses higher concern about technical limitations, security issues, and policy usage constraints. These regional differences underscore the need for tailored strategies to address specific challenges in each area.

Breakdown Between Europe and Latin America and the Caribbean

The analysis of responses regarding the potential benefits of the BELLA infrastructure in collaboration activities across different application areas, and the challenges related to the exploitation of the full potential of BELLA, reveals several similarities and differences. While

similar concerns and viewpoints may be found between both regions, gaining a deeper understanding of what unites and divides Europe and LAC in this regard is crucial.

Similarities

In LAC and Europe, "Collaboration opportunities" emerge as the most recognized benefit of the BELLA network, with 68.67% and 59.57% of respondents acknowledging its importance, respectively. This indicates a shared belief in BELLA's potential to enhance collaborative activities across both regions. Additionally, both regions also highlight "Enhanced connectivity" (LAC: 62.05%; Europe: 48.94%) and "Improved data transfer speeds" (LAC: 59.04%; Europe: 46.81%) as the second and third benefits of BELLA, reflecting a consensus on the infrastructure's role in to support collaborative initiatives in digital transformation.

On the other hand, both Latin America and Europe share similar views on the importance of various technological areas for digital transformation. High-Performance Computing stands out as the most critical area in both regions, with average ratings of 3.47 in Latin America and 3.35 in Europe, highlighting a mutual acknowledgment of its significance. Additionally, Cloud Computing (LAC:3.44; Europe:3.21) and Virtual Research Environments (LAC:3.45; Europe: 3.19) also receive high ratings in both regions, underscoring their essential role in advancing digital transformation efforts.

Lastly, both Europe and LAC identify the lack of awareness as the primary barrier to adopting BELLA, with 59.57% and 77.11% of respondents citing this challenge, respectively. This similarity underscores that there is still room for improvement to enhance understanding and promote the utilisation of BELLA across regions.

Differences

Despite the overall agreement on the benefits, significant differences exist between LAC and Europe in their perceptions of BELLA. LAC respondents demonstrate a stronger appreciation for the benefits related to "Access to advanced technologies," with 58.43% noting its significance, compared to 36.17% in Europe. This suggests a greater recognition among LAC participants of the technological advancements facilitated by BELLA.

Also, while both regions prioritise "High-Performance Computing," "Cloud Computing," and "Virtual Research Environments," LAC respondents tend to emphasise "Artificial Intelligence / Machine Learning," "Cybersecurity tools and technologies," and "Mobile (5G / 6G / OpenRAN)" slightly more than Europe does. Conversely, European respondents rate "Blockchain" and "Quantum technologies" lower than LAC, indicating differing focuses on specific technological areas relevant to digital transformation efforts.

Moreover, LAC organisations encounter more pronounced challenges with budget constraints, as 48.80% of respondents cite financial limitations, compared to 21.28% in Europe. Additionally, LAC faces more significant technical limitations, identified by 28.31% of respondents, compared to 14.89% in Europe, suggesting disparities in infrastructure readiness and technological capabilities. In contrast, Europe expresses heightened concerns about security (21.28%) and policy usage constraints (23.40%), compared to LAC (9.04% and 15.06%, respectively), highlighting different levels of commitment regarding data protection and regulatory compliance within the European context.

Lastly, Europe reports another range of challenges as shortages in cybersecurity personnel, limited staffing, and bureaucratic hurdles (21.28%), compared to LAC (9.04%), reflecting unique organisational and operational barriers that need region-specific strategies to facilitate successful exploitation of BELLA.

> **Findings on the BELLA potential for digital transformation**
>
> - Respondents acknowledge the BELLA network's **perceived capacity to foster partnerships** by enhancing connectivity and facilitating access to advanced technologies. The results emphasise the critical importance of High-Performance Computing, Artificial Intelligence / Machine Learning, and Cloud Computing in driving digital transformation efforts supported by the BELLA network.
>
> - Regional differences are evident in the prioritisation of technological areas for digital transformation efforts. Latin America and the Caribbean prioritise "Artificial Intelligence / Machine Learning," "Cybersecurity," and "Mobile (5G / 6G / OpenRAN)" more than Europe.
>
> - The primary obstacle to the widespread adoption of the BELLA network is a **lack of awareness across both regions.** Bridging this gap is essential for boosting the network's visibility, fostering broader adoption, and fully exploiting its potential.
>
> - **Budgetary constraints emerge as a significant hurdle**, particularly in Latin America and the Caribbean, while **technical limitations** also pose challenges to effectively utilising BELLA. On the other hand, European respondents express **strong concerns about policy usage,** highlighting the need for robust policy frameworks and tailored security measures. These efforts are crucial for **instilling trust and ensuring the smooth implementation** of the BELLA network within regional contexts.

3.5. *Insights from Respondents*

In the survey's final section, respondents were invited to voluntarily share comments to improve connectivity for EU-LAC collaboration. In total, 51 individuals (14.28%) provided comments, with more detailed responses.

Based on the feedback gathered from this last section, the comments from respondents can be categorized into four main areas: **Information and Awareness Gaps on Connectivity**, **Recommendations to Enhance Connectivity for EU-LAC Collaboration**, **Positive Feedback and Endorsements**, and **Regional-Specific Issues and Suggestions**. These categories provide a complete view of the respondents' viewpoints, highlighting areas where more information is needed, expressing satisfaction and support for ongoing efforts, and addressing specific regional issues that may affect the utilisation and effectiveness of the BELLA network:

Information and Awareness Gaps on Connectivity

- Comment from survey respondent: *"I don't have much information on connectivity issues, I think I can't contribute much to this survey."*

- Comment from survey respondent: *"Not sure about my answers to this question (about the use of cloud providers) as I'm not fully knowledgeable on this."*

- Comment from survey respondent: *"I am sorry that I could not provide more accurate answers, as I am not familiar with the source of the digital infrastructure provided at our organisation."*

- Comment from survey respondent: *"I would like to learn more about the BELLA Network."*

- Comment from survey respondent: *"I would like to know more about the SPIDER project and how we as a country can work and reactivate the project in Guatemala."*
- Comment from survey respondent: *"More information is needed*."
- Comment from survey respondent: *"I would like to have more context about the services provided by BELLA Network and success stories in private business."*

Recommendations to Enhance Connectivity for EU-LAC Collaboration

- Comment from survey respondent: *"Improve coordination between actors."*
- Comment from survey respondent: *"Improve connectivity and information exchange."*
- Comment from survey respondent: *"Improve dissemination."*
- Comment from survey respondent: *"Investigate further collaboration areas. Present them in showcases."*
- Comment from survey respondent: *"Carry out training activities on the subject."*
- Comment from survey respondent: *"It is important to generate spaces for dissemination and invite delegations from each institution."*
- Comment from survey respondent: *"Timely teaching and permanent training on current cyber space."*
- Comment from survey respondent: *"Main opportunities are on the test beds to provide demos of state-of-the-art technologies and developments."*
- Comment from survey respondent: *"Consider initial funding and low costs to promote collaboration."*

Positive Feedback and Endorsements

- Comment from survey respondent: *"Very happy with EU-LAC connectivity."*
- Comment from survey respondent: *"Opportunity for all."*
- Comment from survey respondent: *"We currently have BELLA but it is not being exploited, we are looking for BELLA II to make a more profitable and attractive business model."*
- Comment from survey respondent: *"Our collaboration with LAC countries is basically done in EU-funded research projects."*

Regional-Specific Issues and Suggestions

- Comment from survey respondent: *"I don't see participation from my country Bolivia, I work in experimental health research."*
- Comment from survey respondent: *"The Costa Rican NREN is public, so it connects higher education institutions or research centers of CONARE. However, efforts should be made to connect other types of organisations such as schools, hospitals, government entities, laboratories, among others, and thus democratize its use."*
- Comment from survey respondent: *"More investment in university research is needed."*

4. Conclusion

This survey delves into the current state of the digital ecosystem interconnectivity and the potential of the BELLA Infrastructure for digital transformation, as BELLA provides long-term high-capacity interconnectivity through NRENs.

The findings highlight the critical role of high-speed internet for research and innovation activities and digital transformation. While some users express satisfaction with existing services, a notable portion, primarily in LAC, faces challenges impacting their research and business operations. This underscores the need for continuous connectivity improvement and efforts to close the digital divide between regions.

The survey captures a dynamic computing landscape, with a growing shift towards cloud-based solutions, particularly in LAC, alongside the continued utilisation of traditional research infrastructures. Yet, the diversity in needs and connectivity providers, amplifies the importance of tailored strategies to address regional and sector-specific needs, fostering a more robust and resilient digital ecosystem.

Another key takeaway is the insufficient awareness of NRENs in both regions, suggesting more effective outreach efforts need to be undertaken to overcome this challenge that is critical for the expansion of BELLA. Moreover, the data also reveals mixed patterns regarding NREN connectivity utilisation, with a significant percentage relying on these services regularly, while another sizable portion rarely or never uses them. This underscores the need to address the varying levels of NREN adoption and bridge the gap between regions.

Despite this, the survey acknowledges the potential of BELLA to foster partnerships and facilitate access to advanced technologies. Respondents recognize its role in propelling digital transformation efforts, particularly in areas like High-Performance Computing, Artificial Intelligence/Machine Learning, and Cloud Computing. Notably, regional priorities differ, with LAC placing greater emphasis on Artificial Intelligence and mobile technologies compared to Europe, concluding on the differing emphases on specific technological areas relevant to digital transformation efforts.

Nonetheless, significant hurdles remain. A lack of awareness across both regions is the primary obstacle, hindering wider adoption and maximising BELLA's potential. Budgetary constraints, especially in LAC, and technical limitations pose additional challenges that require targeted strategies for financial assistance and technical support. Finally, the survey highlights European concerns regarding policy usage and security measures. Addressing these concerns through strategies tailored to different regional contexts is crucial for building trust and ensuring the smooth implementation of BELLA.

In conclusion, the BELLA Infrastructure offers tremendous potential for fostering collaboration in research and innovation between Europe and LAC. However, unlocking this potential needs a multifaceted approach. Enhancing awareness, addressing budgetary and technical constraints, and implementing robust policy frameworks are critical steps. By prioritising these actions, BELLA can truly bridge the digital divide and propel a new era of collaborative research and advancement across the Atlantic.

Annex 1- QUESTIONNAIRE

Survey on the digital ecosystem interconnectivity in LAC and EU

Welcome to the SPIDER survey!

The survey aims to evaluate the digital ecosystem interconnectivity and the potential of the BELLA Infrastructure that provides the long-term high-capacity interconnectivity to European and Latin American and the Caribbean research and education networks (NRENs), and to all the universities, education centers, research and innovation centers, astronomical observatories, among others, that are part of the NRENs.

Please note that your responses will be kept absolutely confidential and will not be disclosed to any third parties. Data will be used in aggregated form only and individual comments will not be attributed to their originators. Participation in this survey is voluntary. You may leave the survey at any time.

Survey on the digital ecosystem interconnectivity in LAC and EU
Section A - Basic Information

* 1. Gender

○ Woman

○ Man

○ Nonbinary

2. Organization name (optional)

[   ]

* 3. What is your current position in your organization?

○ Researcher

○ Professor

○ Director

○ Consultant

○ Manager

○ CEO, COO, CFO

○ IT personnel

○ Other (please specify)

```
[                                    ]
```

* 4. How would you describe your organization? Please select the option that best describes your organization

○ NREN - National Research and Education Network

○ RFO - Research Funding Organisation

○ RPO - Research Performing Organisation

○ Public University

○ Private University

○ Private organization – Service provider/ Manufacturing

○ Government organization

○ Innovation Hub / Technology park

○ NGO: Non-Governmental Organization

○ Other (please specify)

```
[                                    ]
```

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* 5. How many employees does your organization have?

○ <10 employees

○ 11- 50 employees

○ 51- 250 employees

○ > 250 employees

* 6. What country is your organization located in?

[   ]

* 7. What region is your organization located in?

○ Latin America and the Caribbean (LAC)

○ European Union (EU)

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Survey on the digital ecosystem interconnectivity in LAC and EU

* 8. Does your organization collaborate with Europe?

○ Yes

○ No

○ Don't know

○ Not yet, but plan to

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Survey on the digital ecosystem interconnectivity in LAC and EU

* 9. Does your organization collaborate with LAC?

○ Yes

○ No

○ Don't know

○ Not yet, but plan to

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Survey on the digital ecosystem interconnectivity in LAC and EU
Section B - Connectivity Requirements Assessment

* 10. **How important is a high-speed internet connection for your activities?** From 1 (Not at all important: I can keep running my business/ research even without Internet for a couple of days) to 4 (Extremely important: I cannot run my business/ research without Internet)

1	2	3	4
○	○	○	○

* 11. **How satisfied are you with your current internet connectivity for your activities?** From 1 (Very dissatisfied: low speed or frequent instability affects my business/ research) to 4 (Very satisfied: I can do everything my business/ research need)

1	2	3	4
○	○	○	○

* 12. Does your organization need to make use of research infrastructures or computing resources (ex. processing, storage, databases, etc.) remotely hosted by a research organization for your activities?

○ Yes

○ No

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Survey on the digital ecosystem interconnectivity in LAC and EU
Section B - Connectivity Requirements Assessment

13. Since your answer was "yes", please indicate the type of research organization and country where it is located

[   ]

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Survey on the digital ecosystem interconnectivity in LAC and EU
Section B - Connectivity Requirements Assessment

* 14. Does your organization need to make use of computing resources (ex. processing, storage, databases, etc.) hosted by a cloud provider for your activities?

○ Yes

○ No

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Survey on the digital ecosystem interconnectivity in LAC and EU
Section B - Connectivity Requirements Assessment

15. Since your answer was "yes", please specify.

* 16. Please select the applications or services and the provider you are using for your activities (multiple choice).

	National Research and Education Network (NREN)	Telecommunications provider	Small company
Internet connectivity	○	○	○
DNS services	○	○	○
v4/v6 address space	○	○	○
eduroam	○	○	○
Identity Federation	○	○	○
Education / training Platforms	○	○	○
Collaboration Platforms	○	○	○
Large file transfers (eNVIO / FileTransfer / Filesender)	○	○	○
Virtual private networks (VPN) / layer 2 VLANs	○	○	○
Repositories (for code or data)	○	○	○
Testbeds / Test facilities	○	○	○
Cloud Services	○	○	○
Blockchain	○	○	○
Consultancy	○	○	○
Cybersecurity services	○	○	○

Section C - EU-LAC Interconnectivity
BELLA provides the long-term high-capacity interconnectivity between GÉANT, in Europe, and RedCLARA, in Latin America and the Caribbean, interconnecting the National Research and Education Networks (NRENs) of the two regions.

* 17. How familiar are you with your local NREN?

○ Very familiar

○ Somewhat familiar

○ Not very familiar

○ Not at all familiar

* 18. To what extent is your organization using connectivity provided by your local NREN?

○ Always

○ Often

○ Rarely

○ Never

○ Currently no NREN in my country

○ Other reason not to use your local NREN (please specify)

[   ]

* 19. Is your organization planning to use connectivity provided by your local NREN in the next two years?

○ Yes

○ No

○ Maybe

Survey on the digital ecosystem interconnectivity in LAC and EU
Section C - EU-LAC Interconnectivity

20. Since your answer was "No", please specify the reason

[   ]

Survey on the digital ecosystem interconnectivity in LAC and EU
Section C - EU-LAC Interconnectivity

* 21. How do you think BELLA can benefit your collaboration activities in the following application areas (select at least one):

☐ Enhanced connectivity

☐ Improved data transfer speeds

☐ Improved latency

☐ Collaboration opportunities

☐ Cost-effectiveness

☐ Access to advanced technologies

☐ Other (please specify)

[   ]

22. What do you think are the most important technology areas that support the digital transformation and thus can benefit from the use of BELLA?

	Not Relevant	Relevant	Important	Very important
Artificial Intelligence / Machine Learning	○	○	○	○
Mobile (5G / 6G / OpenRAN)	○	○	○	○
Blockchain	○	○	○	○
Cloud Computing	○	○	○	○
High Performance Computing	○	○	○	○
Cybersecurity tools and technologies	○	○	○	○
Virtual Research Environments (ex. virtual laboratories, simulators, science gateways, data repositories)	○	○	○	○
Quantum technologies	○	○	○	○

Other (please specify)

Survey on the digital ecosystem interconnectivity in LAC and EU
Section D - Barriers to use the BELLA Network

* 23. What do you think are the main barriers or reasons preventing the use of BELLA through your local NREN? (Select all that apply)

☐ Lack of awareness

☐ Technical limitations

☐ Budget constraints

☐ Security concerns

☐ Policy usage constraints

☐ Other (please specify)

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Survey on the digital ecosystem interconnectivity in LAC and EU
Section E - Suggestions and Feedback

24. Are there any additional comments you would like to provide to improve connectivity for your EU-LAC collaboration?

25. Would you like to stay updated about SPIDER?

☐ I would like to receive the result of the survey.

☐ I would like to be invited to participate in focus groups with experts and policy makers on the adoption of the technologies I've chosen above.

☐ I would like to be invited to participate in the SPIDER Community of Practice.

26. If you checked one of the boxes above, please provide your e-mail address:

Annex 2 – EXAMPLES OF PROMOTION ACTIONS

Survey Blog Full Text

NEWS

Digital Survey: Join Us in Advancing EU-LAC Digital Cooperation

At the heart of our mission lies a steadfast commitment to nurturing and advancing the longstanding collaboration between the European Union and Latin America and the Caribbean (EU-LAC) for a truly inclusive digital transformation. Our relentless pursuit of this goal moves us forward, driving us to create an environment conducive to inclusive digital innovation that transcends geographical confines.

To this end, we are carrying out an **online survey** designed to delve into the current state of digital connectivity across Europe, Latin America, and the Caribbean. **Your participation is very important**; your insights and perspectives are invaluable assets as we navigate the complexities of the digital landscape.

Through our meticulously crafted questionnaire, your contributions will serve as guiding lights, illuminating our path toward fostering robust EU-LAC cooperation in digital transformation and research and innovation (R&I). Your input will not only shape our collective understanding but also lay the groundwork for meaningful progress in the realm of digital connectivity.

All responses will be treated with the utmost discretion and confidentiality. Your submissions will remain anonymous and safeguarded within the confines of aggregated data dissemination.

We extend a sincere invitation to seize this opportunity to contribute to our shared mission. Together, let us embark on a journey that holds the promise of redefining the boundaries of innovation and collaboration in the digital sphere.

Take the survey now and assume a pivotal role in shaping the trajectory of digital connectivity. Your engagement serves as a cornerstone in our pursuit of a brighter, more interconnected tomorrow.

Take the survey

Twitter Post

SPIDER
EU-LAC Digital Partnership

LinkedIn Post

SPIDER project
85 followers
2mo · 🌐

We have an announcement! 📣

We're conducting an online survey to explore digital connectivity in Europe, Latin America, and the Caribbean, and your participation and thoughts are invaluable.

This brief questionnaire will also help us assess the potential of the BELLA Infrastructure for enhancing connectivity in research and education networks. 💡
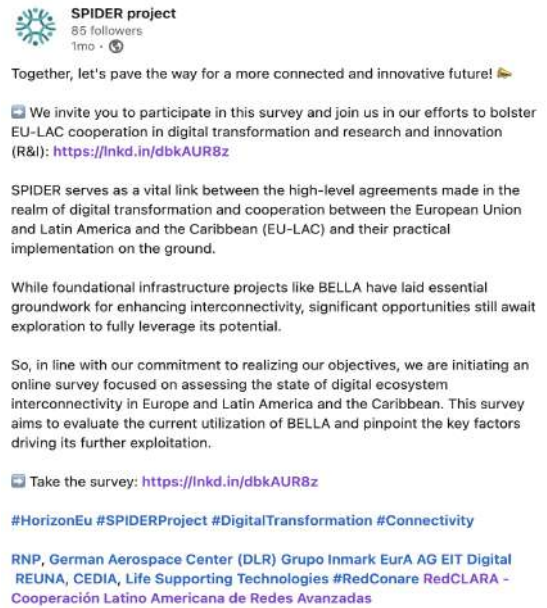
We will share the results on our website following the most rigorous confidentiality standards.

📧 Take the survey and join us as we foster EU-LAC Cooperation on digital transformation and R&I: https://lnkd.in/dbkAUR8z

#DigitalTransformation #connectivity #SPIDERProject #HorizonEu

SPIDER — Survey on the digital ecosystem interconnectivity in LAC and EU
INNOVATE TOGETHER
surveymonkey.com

SPIDER project
85 followers
1mo · 🌐

Together, let's pave the way for a more connected and innovative future! 🎉

📧 We invite you to participate in this survey and join us in our efforts to bolster EU-LAC cooperation in digital transformation and research and innovation (R&I): https://lnkd.in/dbkAUR8z

SPIDER serves as a vital link between the high-level agreements made in the realm of digital transformation and cooperation between the European Union and Latin America and the Caribbean (EU-LAC) and their practical implementation on the ground.

While foundational infrastructure projects like BELLA have laid essential groundwork for enhancing interconnectivity, significant opportunities still await exploration to fully leverage its potential.

So, in line with our commitment to realizing our objectives, we are initiating an online survey focused on assessing the state of digital ecosystem interconnectivity in Europe and Latin America and the Caribbean. This survey aims to evaluate the current utilization of BELLA and pinpoint the key factors driving its further exploitation.

📧 Take the survey: https://lnkd.in/dbkAUR8z

#HorizonEu #SPIDERProject #DigitalTransformation #Connectivity

RNP, German Aerospace Center (DLR) Grupo Inmark EurA AG EIT Digital REUNA, CEDIA, Life Supporting Technologies #RedConare RedCLARA - Cooperación Latino Americana de Redes Avanzadas

Partners Social Media Channels

🔁 You reposted

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@Red_REUNA
···

📢 Te invitamos a participar en esta encuesta y compartir tu opinión sobre la interconectividad del ecosistema digital en ALC-UE y el potencial de BELLA.
El cuestionario está disponible en línea en
surveymonkey.com/r/7PZKVRD?lang... y tardarás 10 minutos en completarlo. No te quedes fuera!

Translate post

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EU-LAC Digital Partnership

Encuesta online:
Únase a nosotros
para promover la
cooperación digital
UE-ALC

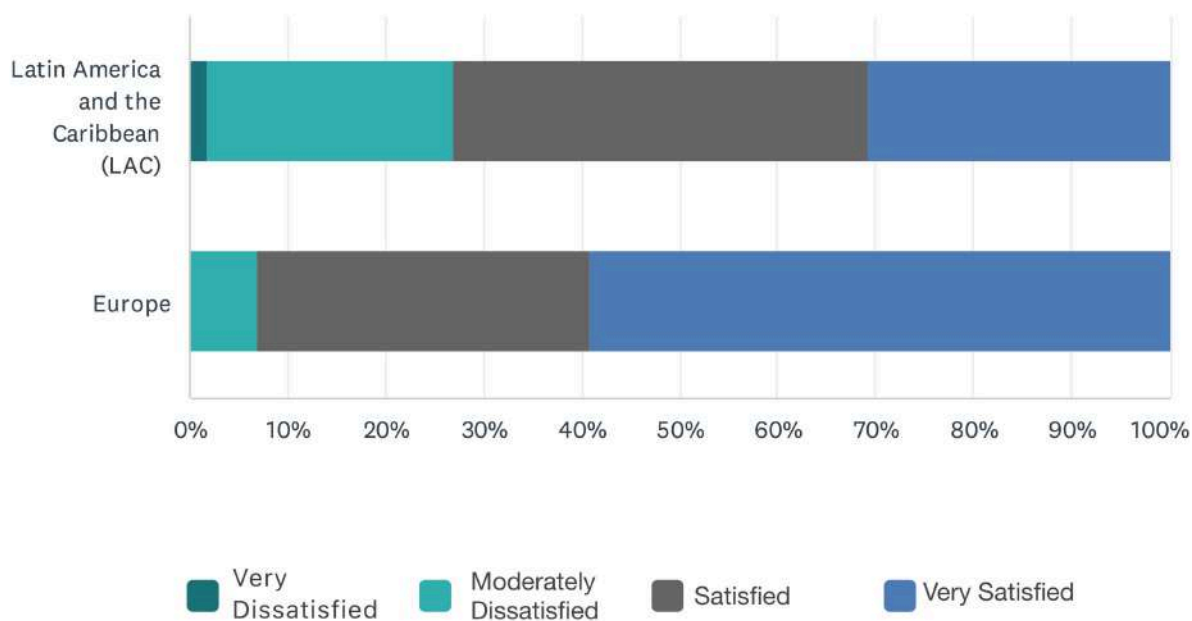## Survey Email Campaign

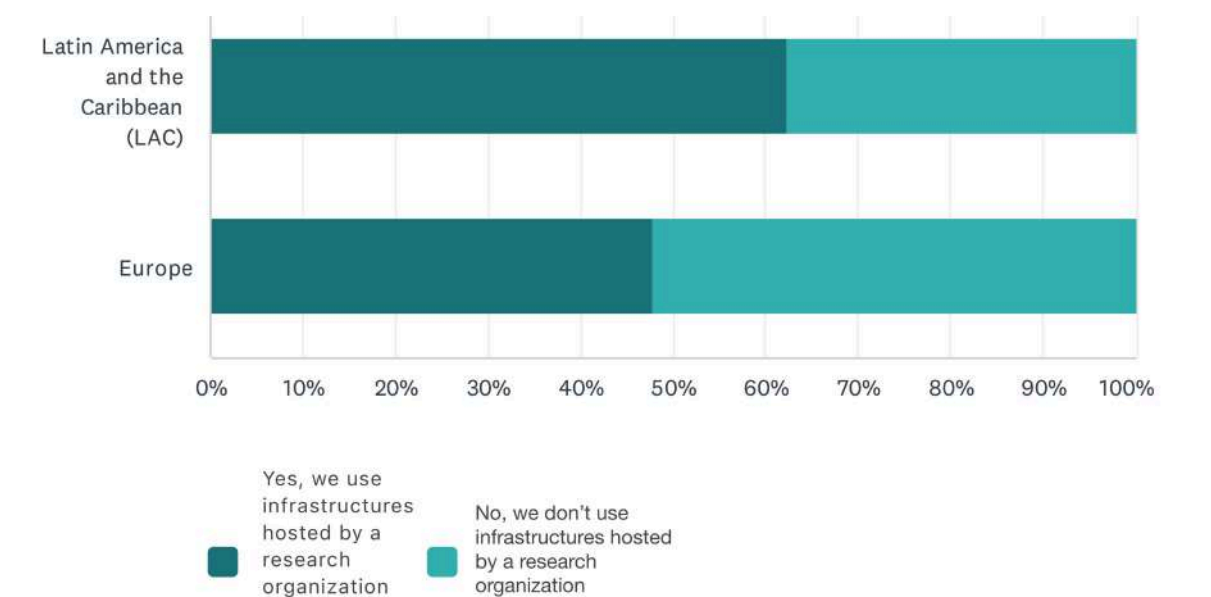# Annex 3 – Graphical Comparison by Region

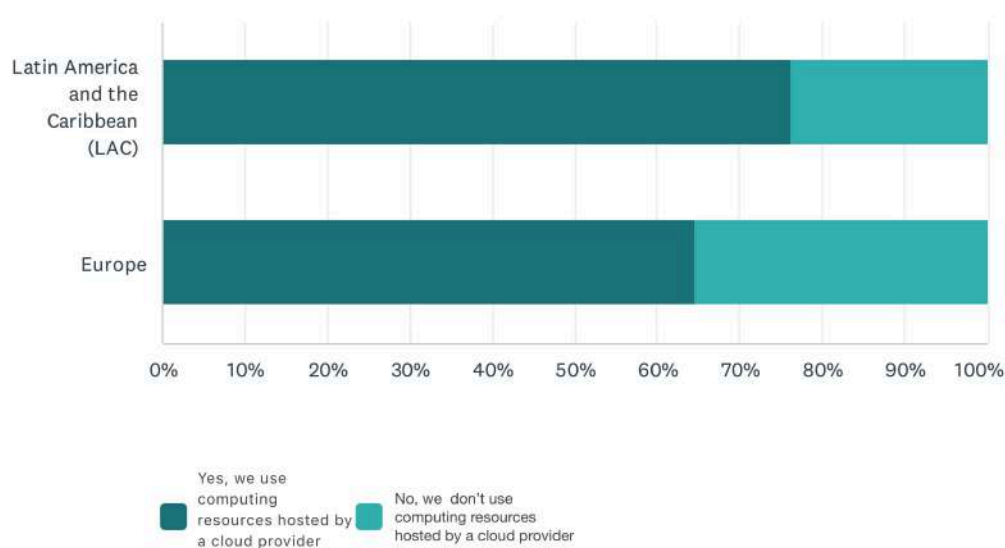## 1. Importance of high-speed internet connection
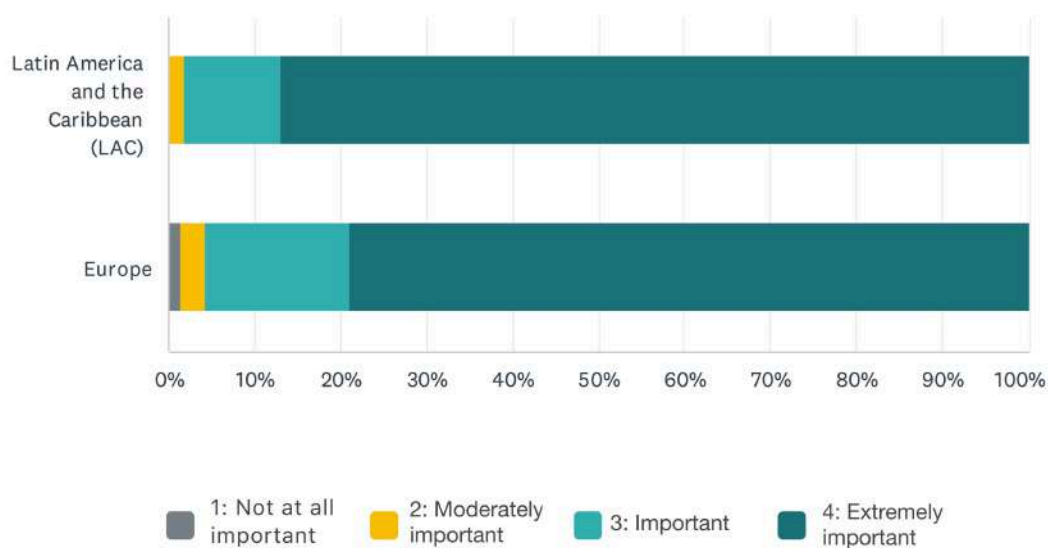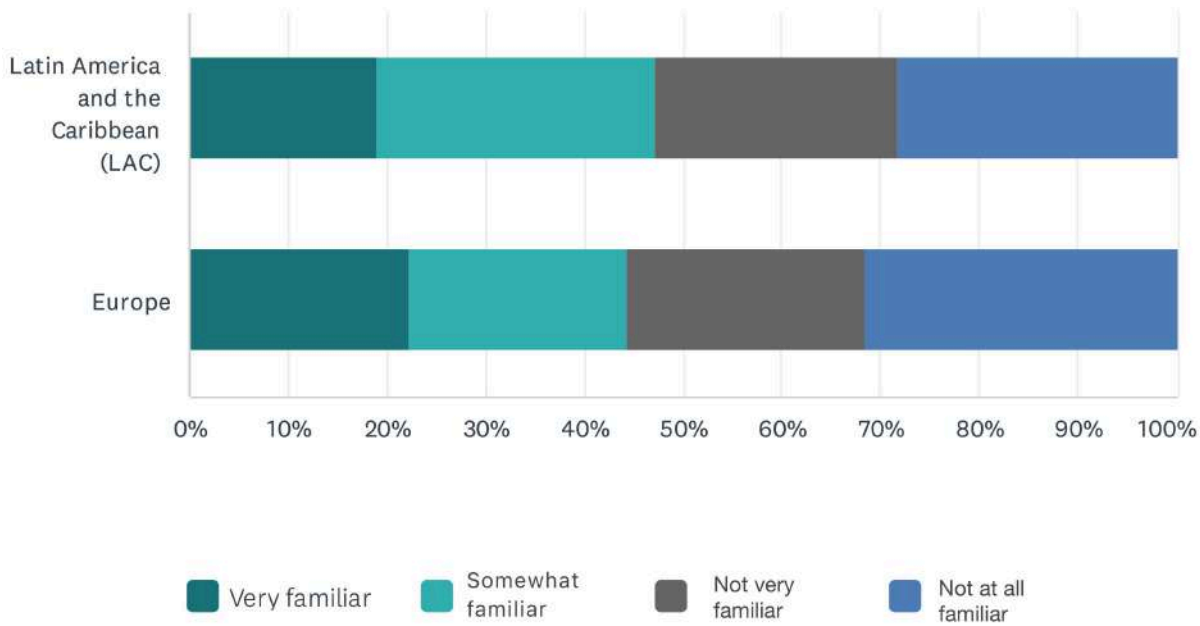

2. Internet connection satisfaction

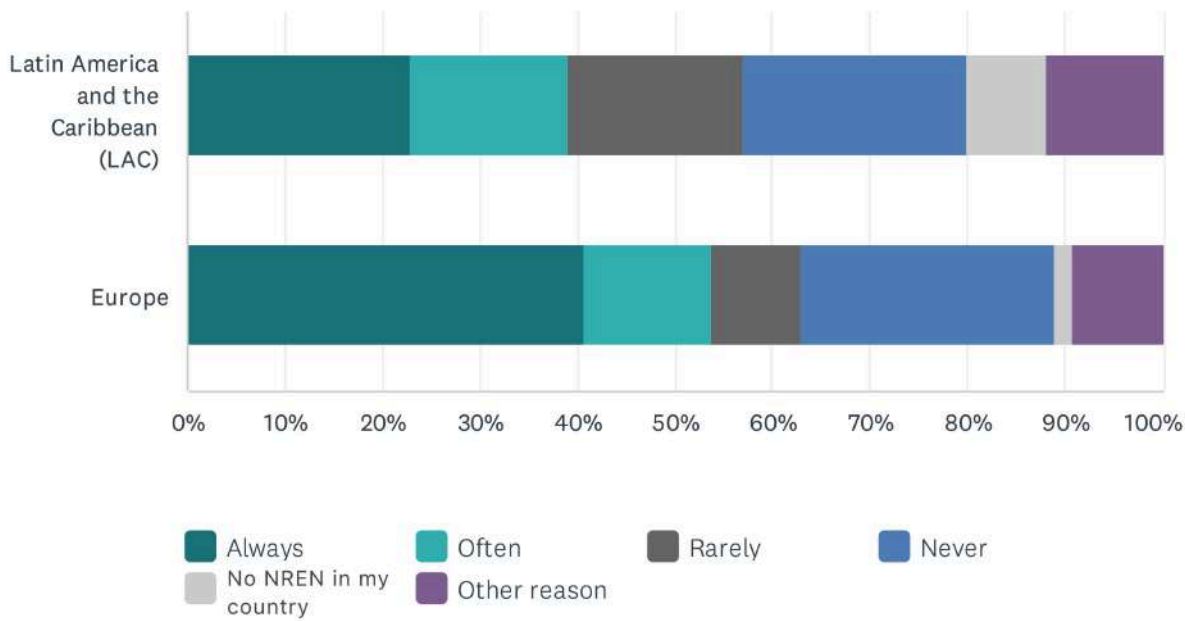### 3. **Use of infrastructures or computing resources hosted by a research organization**

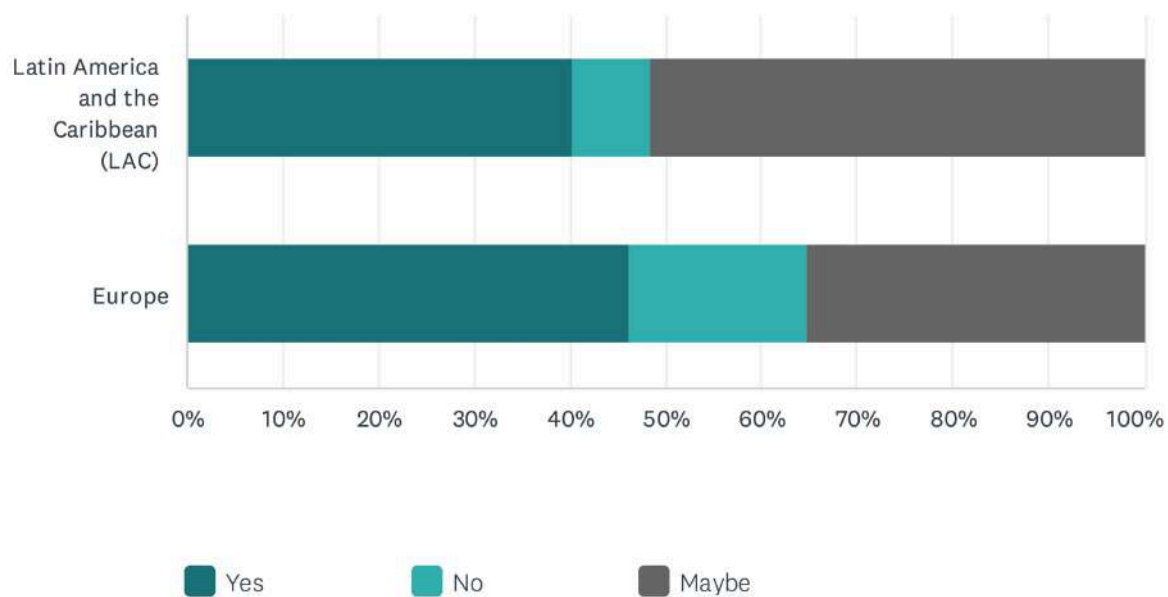### 4. **Use of computing resources hosted by a cloud provider**

5. **Familiarity with local NREN**

Legend:
- Very familiar
- Somewhat familiar
- Not very familiar
- Not at all familiar

6. **Use of connectivity provided by local NRENs**

Legend:
- Always
- Often
- Rarely
- Never
- No NREN in my country
- Other reason

7. Plans to use connectivity provided by local NRENs in the next two years

CITATION

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Report author: SPIDER Project

Website: https://spidernetwork.org/