YOFI

ORRI GUİDE FOR BALKAN YOUNG RESEARCHERS

REINFORCING Grantee

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Executive summary

This guide provides a comprehensive framework to promote **Open and Responsible Research and Innovation (ORRI)** among young researchers in the Balkan region. ORRI principles—focusing on **openness, transparency, inclusivity, and societal impact**—are essential for fostering ethical and impactful research that aligns with societal needs. The guide addresses both opportunities and barriers to ORRI adoption and provides practical tools, methodologies, and policy recommendations to enable researchers to embrace ORRI principles effectively.

This guide serves as a practical resource for young researchers in the Balkans to integrate ORRI principles into their work. By addressing key challenges and offering tailored strategies, it empowers individuals to adopt open, responsible, and inclusive research practices. Additionally, the proposed policy recommendations aim to create a supportive ecosystem that drives ORRI adoption across institutions and countries in the Balkan region.

Through collaborative efforts and sustained support, ORRI can become a cornerstone of the research landscape in the Balkans, fostering innovation that is ethical, transparent, and aligned with societal values.

Key Context and Purpose

The adoption of ORRI practices in the Balkan region has been gradual but promising, influenced by European Union frameworks and local initiatives. This guide aims to:

- Raise awareness of ORRI principles.
- Provide actionable steps to integrate ORRI into individual research practices.
- Address challenges such as **financial barriers, training gaps, institutional resistance, and limited collaboration opportunities**.
- Offer policy recommendations to support the sustainable adoption of ORRI across the research ecosystem.

Current Practices and Opportunities

An analysis of existing ORRI practices across the Balkans highlights several promising initiatives:

- Organizations like **Open Data Kosovo** and **COHU** in Kosovo, and platforms like **Zenodo** in Albania and Bosnia, have led efforts to promote open access and transparency.
- Institutions in Serbia, Croatia, and Slovenia have embraced Open Science practices, while NGOs are fostering public engagement and inclusivity.

- Despite progress, challenges remain, including the need for enhanced funding, awareness, infrastructure, and public involvement.

These findings provided the basis for a regionally tailored ORRI framework.

Survey Insights and Identified Barriers

A survey conducted with young researchers in **North Macedonia and Kosovo** revealed the following key findings:

- **Familiarity**: Awareness of ORRI principles remains moderate, with only a small percentage highly familiar.
- **Relevance**: Open Access and Public Engagement are seen as the most relevant dimensions, while inclusivity (e.g., gender and diversity) requires greater emphasis.
- **Barriers**: Financial constraints (60%), lack of training (60%), and institutional policies (35%) emerged as the primary challenges.
- **Support Needs**: Researchers emphasized the need for funding, workshops, access to tools, and collaboration platforms.

These insights informed the practical recommendations and step-by-step guidelines presented in this guide.

Practical ORRI Guidelines for Young Researchers

The guide outlines a **step-by-step methodology** tailored to empower individual researchers to integrate ORRI principles into their work. The steps address specific challenges and include:

1. **Assess Your Readiness**: Conduct a personal ORRI self-assessment to identify gaps and set goals.
2. **Secure Funding**: Access grants, explore fee waivers, and collaborate to reduce financial burdens.
3. **Build Knowledge**: Attend free training programs, webinars, and workshops to enhance skills.
4. **Adopt Open Science**: Share research through open-access repositories and FAIR data principles.
5. **Strengthen Public Engagement**: Engage with local communities, participate in citizen science, and communicate findings effectively.
6. **Overcome Institutional Barriers**: Advocate for supportive policies and frameworks in your institution.
7. **Monitor and Share Progress**: Evaluate your efforts and share success stories to inspire peers.

This framework provides a clear roadmap for young researchers to practice responsible, open, and inclusive research.

Key Policy Recommendations

To address systemic challenges, the guide proposes key recommendations for policymakers, institutions, and research organizations:

1. **Establish Dedicated Funding Mechanisms**: Introduce grants, micro-financing, and funding incentives to support ORRI activities.
2. **Develop Institutional Policies**: Promote mandatory open-access policies and reward ORRI-aligned practices.
3. **Invest in Capacity Building**: Provide targeted training programs and integrate ORRI into academic curricula.
4. **Foster Collaboration**: Build regional networks, platforms, and interdisciplinary partnerships.
5. **Support Ethical and Inclusive Research**: Encourage ethical frameworks, gender-balanced teams, and societal impact initiatives.
6. **Promote Public Engagement**: Require outreach activities and citizen participation in research projects.
7. **Ensure Accountability**: Implement monitoring systems and publish progress reports on ORRI adoption.

These policies will create an enabling environment where researchers can thrive and contribute to sustainable research practices.

Chapter 1: Introduction to Open and Responsible Research and Innovation

1.1 Definition and purpose

Open and Responsible Research and Innovation (ORRI) is a concept introduced by the European Commission (EC) that emphasizes openness, transparency, diversity, and inclusion in shaping policies, programs, and activities within the research and innovation (R&I) domain. It aims to align technological advancements with societal values, ensuring that research outcomes are ethically sound, sustainable, and socially desirable. ORRI provides a guiding structure for institutional decision-making under conditions of uncertainty and complexity, helping researchers and policymakers address societal challenges responsibly.

By prioritizing openness and engagement, ORRI promotes inclusive participation in the research process, fostering innovation that is both impactful and accountable. The framework encourages anticipation and reflexivity, asking stakeholders to consider the future implications of their work and remain adaptive to evolving challenges. ORRI integrates principles that reshape traditional research practices to emphasize accessibility, transparency, and sustainability. This ensures that scientific and technological advancements are not only academically rigorous but also socially relevant and beneficial.

By embedding societal values into the research process, ORRI advocates for a forward-thinking approach to innovation, moving beyond conventional scientific aims to address broader societal concerns. It encourages research that is accountable, inclusive, and grounded in ethical standards. With its focus on producing outcomes that meet societal needs and promote sustainable development, ORRI represents a transformative model for research and innovation, aligning scientific exploration with the priorities of a rapidly changing world. This approach ensures that research contributes meaningfully to societal progress while addressing contemporary challenges responsibly.

Over time, the ORRI approach has evolved, emphasizing the importance of prioritizing societal challenges in scientific research while also defining the means to achieve this goal. In this framework, Open and Responsible Research and Innovation focuses on maintaining strict ethical standards in research, promoting gender equality within the scientific community, and ensuring policymakers take proactive responsibility to mitigate any potential negative impacts of innovation. It also highlights the need to involve communities directly affected by innovation, providing them with the necessary knowledge to comprehend its implications. This is supported by advancing science education and ensuring research findings are openly accessible through Open Access initiatives.

ORRI plays a crucial role in shaping our future. These guidelines outline what ORRI entails and how it will help research and innovation contribute to building an inclusive, sustainable, and healthy future. As a key action under the "Science with and for Society" objective of the European Commission’s Horizon 2020 Programme, ORRI introduced a fresh perspective that balances commercial objectives with broader societal well-being. A fundamental aspect of ORRI is the active involvement and participation of people in the research process. According to the European Commission, this approach fosters "better alignment," ensuring that research and innovation incorporate the essential element of responsibility.

A key concern for all stakeholders is how to integrated ORRI into their mindset. Addressing this concern encourages stakeholders to reflect on how their individual, collective, or organizational actions contribute to balancing research and innovation goals with broader societal considerations.

ORRI serves as both a way of thinking and a practical approach, guiding research and development in ways that are ethically sound. It emphasizes the importance of maximizing social and commercial benefits while minimizing or avoiding harm to the social and physical environment. The guidelines provide clarity on these issues by explaining how the various "dimensions" and "principles" of ORRI connect to the interests and responsibilities of different stakeholder groups.

1.2 Key ORRI dimensions and principles

The five key dimensions of ORRI within the Horizon Europe framework are **Public engagement, Open access, Gender, Ethics** and **Science education**. They emphasize inclusivity, transparency, and responsibility in research and innovation.

Besides the key dimensions, in the Horizon Europe framework additional dimensions could be recognized, such as **Social justice/Inclusion, Sustainability, Privacy/Data protection, Safety** and **Accountability**. There is additional ORRI dimension, **Governance**, which creates mutual framework for all previously presented dimensions. In the following part of the Guidelines the main features of the ORRI dimensions will be presented.

1. **Public engagement,** including Citizen Science, **Public Engagement**, and **Open Access** are central components of **Open Science**, promoting the idea that research publications and data should be "as open as possible, as closed as necessary" to balance accessibility and privacy. To ensure effective engagement, the methods used must account for potential biases that may arise from individuals' unique perspectives, life experiences, or cultural backgrounds. The engagement requires a reflective mindset from all participants, including researchers, to set aside any preconceived notions, deeply rooted beliefs, or personal biases. This reflexivity ensures a more inclusive and balanced dialogue, fostering mutual understanding and collaboration.

2. **Open access** ORRI plays a crucial role in promoting good research practices, where transparency, open access, and knowledge sharing are fundamental components. Sharing knowledge not only allows others to adopt or adapt effective methods but also fosters innovation by building on established best practices. Open access serves as a vital tool for connecting people and ideas, creating opportunities to drive scientific progress and innovation. It is indispensable for enhancing the dissemination and exchange of scientific knowledge among key stakeholders in European research. Additionally, greater collaboration and the active involvement of citizens and society are essential for enhancing transparency in the scientific process.

3. **Gender** is another critical dimension, ensuring balance and inclusivity in research practices, with mandatory Gender Equality Plans for participating institutions. Gender inequality undermines fundamental rights, places a substantial burden on the economy, and leads to the underutilization of available talent. Promoting gender equality can unlock economic and business advantages by maximizing the potential of a diverse workforce. The call for greater gender equality within ORRI aligns strongly with European policy priorities, highlighting its importance as a fundamental aspect of fostering equitable and effective research and innovation practices. However, significant gender imbalances are particularly noticeable in technical fields, which are often male-dominated and serve as a key source of scientific researchers. Addressing these disparities poses a considerable challenge for ORRI and is essential for fostering inclusive and balanced innovation ecosystems.

4. **Ethics** is foundational to ORRI, requiring compliance with General Data Protection Regulation (GDPR) and adherence to the FAIR (Findable, Accessible, Interoperable, Reusable) data principles, ensuring ethical data management and transparency. EU has a vital role in promoting global adherence to European ethical standards for conducting scientific research. To maintain strong ethical standards, responsible research must rely on up-

to-date, well-informed data that reflects strategic policy, technological advancements, and social and cultural trends. Moreover, it must address the needs and preferences of diverse stakeholders, ensuring their voices are heard and considered. Transparency in reporting research outcomes, including details about funding sources and methodologies, is also critical.

5. **Science education** is a crucial component of ORRI, which plays an important role, fostering awareness and equipping researchers with the necessary skills to align their work with ORRI principles. It establishes the foundation for developing a knowledgeable, skilled, and capable workforce. This is linked to the European Commission's vision for the European Research Area, and is essential for achieving key objectives in R&I.. By fostering education and skill development, R&I can play a pivotal role in addressing significant societal challenges, enhancing competitiveness, and creating new employment opportunities.

6. **Social justice/Inclusion** as a principle ensures that ORRI is a transparent and collaborative process where social actors and innovators engage in mutual responsiveness. The goal is to ensure the ethical acceptability, sustainability, and societal relevance of the innovation process and its products, facilitating the seamless integration of scientific and technological advancements into society. ORRI encourages societal actors to collaborate throughout the entire R&I process, aiming to align both the process and its outcomes with the values, needs, and expectations of European society. Achieving or enhancing this alignment often requires meaningful engagement between organizations involved in R&I and the broader public.

7. **Sustainability** is an ORRI dimension that emphasize collective responsibility for shaping a sustainable future by carefully managing responsible R&I. The inclusion of environmental stewardship within this ORRI dimension is aligned with EU's proactive climate change policies through its efforts to reduce waste and energy consumption by fostering the creation of efficient and sustainable products. The Priority Area from the ERA Policy agenda, "Taking up together the challenges posed by the twin green and digital transition, and increasing society's participation in the ERA", is also embedded in this ORRI dimension.

8. **Privacy and Data protection**, though connected, are commonly recognized as two separate rights. In Europe, they are considered vital components for a sustainable democracy and inevitable part in R&I activities. In the EU, human dignity is recognised as an absolute fundamental right in all sectors. In this notion of dignity, privacy or the right to a private life to be autonomous, in control of information about yourself, to be let alone, plays a pivotal role. Privacy is not only an individual right but also a social value. Data protection is about protecting any information relating to an identified or identifiable natural person. The

notion of data protection originates from the right to privacy and both are instrumental in preserving and promoting fundamental values and rights. Data protection has precise aims to ensure the fair processing (collection, use, storage) of personal data by both the public and private sectors in all activities, such as R&D and innovation activities.

9. The **Safety** principle within the framework of ORRI, as promoted by the European Commission, emphasizes the responsibility of ensuring that R&I processes, as well as their outcomes, do not pose undue risks to individuals, communities, or the environment. This principle calls for a proactive approach in identifying, assessing, and mitigating potential hazards associated with scientific and technological advancements.

Key aspects of the safety principle include:

- Risk Assessment and Management: Incorporating thorough assessments of potential risks at every stage of the research and innovation lifecycle to anticipate and address possible negative consequences.
- Precautionary Approach: Prioritizing precaution when uncertainties or unknowns are present, particularly in high-impact areas such as biotechnology, artificial intelligence, and nanotechnology.
- Stakeholder Involvement: Engaging diverse stakeholders, including the public, policymakers, and industry, in discussions about safety concerns to build trust and ensure societal needs are addressed.
- Transparency and Communication: Ensuring open communication about safety risks, including methodologies, findings, and decisions, to enable informed decision-making by all stakeholders.
- Compliance with Ethical Standards: Aligning safety considerations with ethical principles to prevent harm and promote well-being.

By embedding safety as a core principle, ORRI seeks to foster responsible research and innovation that contributes positively to society while minimizing risks and uncertainties.

10. The **Accountability** principle in ORRI, as outlined by the European Commission, emphasizes the responsibility of all stakeholders involved in R&I to act transparently, ethically, and in alignment with societal values and expectations. This principle ensures that researchers, policymakers, industries, and other contributors are held accountable for their actions, decisions, and the potential impacts of their work. Key aspects of the accountability principle include:

- Transparency: Clear communication about research goals, methods, funding, and results to foster trust and public understanding.
- Ethical Responsibility: Ensuring that all R&I activities align with ethical standards, respect human rights, and avoid harm to individuals, communities, or the environment.
- Societal Engagement: Involving the public and other stakeholders in the decision-making process to ensure that research and innovation address societal needs and challenges.
- Evaluation and Monitoring: Establishing mechanisms to assess the impact of R&I activities and make adjustments as necessary to ensure they align with intended goals.
- Legal Compliance: Adhering to laws and regulations, including those related to data protection, intellectual property, and environmental sustainability.

The accountability principle ensures that research and innovation processes are not only effective but also socially responsible, promoting trust and credibility in scientific endeavors. This principle is closely tied to the broader goals of ORRI, which include fostering inclusivity, sustainability, and ethical integrity in research and innovation systems.

11. Lastly, **Governance** focused on establishing a framework that incorporates all key elements mentioned above. Together, these dimensions create a robust framework for advancing responsible research and innovation. This ORRI dimension ensures proper governance throughout the research process and emphasizes responsibility and the importance of defining the role of research. It requires governance practices that are flexible yet aligned with broader societal and ethical goals. Good governance inherently includes an ethical dimension that not only ensures research produces clear and beneficial outcomes for society and commerce but also provides a framework that legitimizes the efforts of researchers. This foundation is rooted in governance systems that promote transparency, such as disclosing personal interests or affiliations that could impact decision-making in conducting research or utilizing its results. Good and reflexive governance also demands a strong sense of social awareness, which is fostered through the adoption of ORRI principles.

A central goal of ORRI is to bridge the gap between scientific progress and societal needs. It emphasizes collaboration among diverse actors, including researchers, citizens, policymakers, decision-makers, and businesses, to ensure research aligns with the values, needs, and expectations of European society. This cloud be achieved through **12 key ORRI Principle, as follows:**

1. ORRI emphasizes the significance of **innovation ecosystems** and the **commitment of multiple stakeholders,** to ensure that diverse perspectives and experiences

are integrated into research and innovation processes. This approach fosters inclusivity and collaboration across sectors.

2. ORRI also involves **anticipating future trends and developments**, enabling **strategic adaptation** of activities to promote mutual responsiveness and adaptability in the face of change;

3. A core objective of ORRI is to address **market deficits** that hinder the transformations necessary to achieve the Sustainable Development Goals (SDGs), acknowledging the **unequal benefits** derived from science and technology between developed and developing countries;

4. Additionally, ORRI emphasizes the importance of inclusivity by **broadening representation and participation** in innovation processes to address the needs and perspectives of **vulnerable or marginalized groups**. By ensuring these voices are heard and integrated, ORRI fosters equitable and impactful solutions that benefit diverse communities;

5. To institutionalize these principles, ORRI relies on the development of **indicators and procedures** that enhance **agency, legitimacy, and accountability**. These mechanisms provide a framework for measuring progress, ensuring transparency, and embedding ORRI into the core of research and innovation systems, creating a foundation for long-term sustainability and impact;

6. ORRI adopts a **holistic approach**, recognizing the interconnected factors that shape the development, application, and impact of innovations. This perspective ensures that all relevant dimensions—social, economic, environmental, and cultural—are considered, fostering more comprehensive and sustainable innovation processes;

7. Additionally, ORRI embraces an **experimental mindset**, prioritizing co-creation and the continuous adaptation of social norms, needs, regulations, institutions, and infrastructures;

8. Furthermore, ORRI is rooted in the values of **openness and mutual responsiveness**, advocating for Open Science, Open Innovation, and transparency to foster trust and collaboration among all stakeholders;

9. It emphasizes the importance of institutional structures that uphold **integrity** and ensure adherence to **fundamental ethical standards**, creating a solid foundation for responsible research and innovation;

10. Additionally, ORRI highlights the necessity of quality **science education** to nurture curiosity and improve scientific literacy, enabling greater **public engagement** and fostering active **science citizenship;**

11. ORRI emphasizes the need for **anticipatory, adaptive, and inclusive governance** in research and innovation (R&I) to guide efforts toward outcomes that are socially desirable and beneficial. This approach ensures that governance structures remain flexible and responsive to emerging challenges while actively involving diverse stakeholders in decision-making;

12. Moreover, ORRI ensures that **societal goals** are not only identified but also actively pursued and embedded within the processes and practices of R&I organizations. Together, these principles create an inclusive and ethical framework that strengthens the connection between science, society, and innovation.

1.3 Importance of ORRI for the Western Balkan countries

The Western Balkan (WB) region, with its diverse cultural heritage and complex socio-economic landscape, faces unique challenges in establishing and sustaining robust research and innovation systems. A lack of consistent funding, limited research infrastructure, and the persistent issue of "brain drain" — where skilled researchers, innovators and professionals leave the region for better opportunities abroad — have hindered the potential for scientific and technological advancements. These conditions make the adoption of ORRI principles not just beneficial but essential, as ORRI offers frameworks that can address these specific issues and foster a culture of responsible, impactful research.

WB economies are still in the process of developing robust innovation ecosystems, with significant room for strengthening the collaboration between academia and industry. Building these connections requires a focus on cooperation, shared learning, and mutual benefits for all parties involved. For WB countries, adopting the principles promoted by the European Commission, such as ORRI, is essential. These principles create opportunities to foster trust, enhance collaboration, and improve networking among various stakeholders engaged in R&I activities.

The ORRI framework seeks to bring societal actors together throughout the entire R&I process, including citizens and civil society organisations (CSOs), universities, research institutions, formal and informal education institutions, governments and public authorities, businesses, and social entrepreneurs, ensuring that research activities and their outcomes are closely aligned with societal values, priorities, and expectations. Experiences from several WB initiatives dedicated to ORRI have demonstrated that integrating its strategies and practices can make R&I more inclusive, engaging all relevant stakeholders. This approach has also been shown to enhance the relationship between science and society, attract new talent, and combine scientific excellence with social responsibility and awareness. By prioritizing transparency and inclusivity, ORRI can help counter the negative effects of brain drain, drawing skilled researchers back to the region by promoting an environment of open data, knowledge-sharing, and inclusive research culture. In addition to countering brain drain, ORRI can facilitate economic growth and social resilience in the Balkans by ensuring that research outputs serve local communities directly.

By adopting ORRI principles and actively promoting its key pillars — including gender equality, science education, open access and data sharing, public engagement, and ethical standards — WB countries have the potential to develop self-sustaining R&I ecosystems. These ecosystems would be characterized by openness, democratic governance, and responsiveness to societal needs, paving the way for a greater sustainability and inclusiveness at local, national, EU and global levels.

1.4 Global context: ORRI in R&I

In the global context, research, development, and innovation represent fundamental components of economic systems that drive progress and sustain quality of life. These elements are essential not only for fostering economic growth but also for addressing global societal challenges, thereby playing a vital role in the advancement of the international community. ORRI has emerged as a globally recognized approach that integrates responsible research, which addresses societal and ethical concerns, with innovation, which focuses on technical and commercial advancements. Together, these components create a synergistic framework for sustainable and inclusive global development.

Globally, a central tenet of ORRI is the transformation of science from an isolated endeavor to a collective, inclusive process. Rather than being confined to laboratories and institutions, research under ORRI is opened up to include diverse perspectives and knowledge systems, transforming science into a shared effort toward societal improvement. By encouraging research and innovation through a multistakeholder engagement model, ORRI emphasizes the importance of involving all relevant parties in the research process — from policymakers, industry experts, and academics to local communities, civil society organizations, and end users. This approach fosters **co-creation**, where stakeholders actively participate in defining research questions, designing methodologies, and interpreting results. Through such collaborative efforts, ORRI enables science to be more responsive to public needs, ensuring that outcomes are not only scientifically valid but also socially relevant, ethically sound, and widely supported. This inclusive, participatory model thus redefines the role of science, making it a tool for collective advancement and ensuring that innovations contribute positively and equitably to societal progress.

A key global reference point for ORRI is the 'Guidance on Social Responsibility' provided by the International Standard ISO 26000, which gives comprehensive guidance on social responsibility. This standard emphasizes the necessity of transparency, ethical practices, and active stakeholder involvement, principles that are now widely acknowledged in international research and innovation policies. By adopting such frameworks, ORRI ensures that the outcomes of research and innovation contribute positively to global challenges, such as climate change, public health crises, and digital transformation.

The global relevance of ORRI extends to individuals and institutions alike. Whether as researchers, policymakers, entrepreneurs, or members of the public, ORRI impacts all stakeholders by ensuring that the processes and outcomes of research and innovation address both local and global needs. It promotes trust and cooperation among nations, facilitating international collaboration on shared challenges and opportunities.

ORRI also aligns with global policy agendas, such as the United Nations Sustainable Development Goals (SDGs), by encouraging research and innovation that contribute to sustainable, inclusive, and equitable growth. It bridges the gap between commercial and societal objectives, ensuring that global innovation ecosystems are not only technically advanced but also ethically grounded and socially responsive. In this way, ORRI is a vital framework for shaping research and innovation policies that meet the demands of an interconnected and rapidly changing world.

1.5 Goals of the Guide and Target audience

The guide is intended for all stakeholders within the Quadruple Helix (QH) model, which encompasses academia, industry and business, policymakers, and society at large. Academic actors and researchers are central to this effort and should be motivated to play a leading role in the adoption of ORRI principles. Their expertise in scientific research and their deep understanding of societal challenges position them as valuable contributors who can offer critical insights and share knowledge with other QH representatives. Through their leadership and collaborative spirit, academic stakeholders can drive the integration of ORRI practices across different sectors, ensuring that research and innovation are aligned with societal needs.

In addition to the academic sector, the active involvement of CSOs is crucial. CSOs serve as vital intermediaries, helping to bridge communication and understanding gaps between the QH actors and regional or local communities. Their grassroots connections and community-oriented focus enable them to convey complex concepts in accessible ways and foster trust among stakeholders. Furthermore, CSOs can play a key role in facilitating public engagement, ensuring that the voices of underrepresented groups are included in the R&I process. By building stronger links between the different QH actors, CSOs contribute to creating a more inclusive and collaborative ecosystem for adopting and promoting ORRI principles.

The guide aims to promote the ORRI principles, positioning them as catalysts for shared learning and the dissemination of innovations in R&I governance. By fostering collaboration and knowledge exchange, these principles can significantly improve the planning and execution of R&I initiatives, including the development and implementation of Smart Specialization Strategies (S3) across the region. The specific objectives of the guide are the following:

- Strengthen the capacity of local and regional R&I ecosystems to effectively address pressing societal challenges and align with territorial research priorities;
- Support local R&I organizations in adopting ORRI principles to overcome contemporary challenges faced by scientists and researchers, fostering more responsible and impactful research practices;
- Empower young researchers by providing them with tools, knowledge, and support to integrate ORRI principles into their work, fostering a new generation of responsible and socially engaged scientists;
- Create training programs tailored for young researchers to enhance their skills in ethical research practices, stakeholder engagement, and collaborative innovation, ensuring their active role in advancing regional R&I ecosystems;
- Contribute to the refinement and implementation of Smart Specialization Strategies (S3) in the Western Balkans by advocating for open, inclusive, and participatory approaches to research and innovation policy development;
- Enhance innovation planning processes by tailoring them to address societal and regional needs, ensuring that R&I outcomes are both relevant and beneficial to local communities;
- Facilitate stronger connections and networking opportunities among academia, industry, policymakers, and civil society to create a cohesive and collaborative R&I ecosystem;

- Foster public trust in science and innovation by promoting transparency, accountability, and meaningful stakeholder participation in the R&I ecosystem;
- Advocate for the inclusion of underrepresented groups in the R&I process, ensuring diversity and equity in innovation development and decision-making.

The guide is intended for anyone seeking to apply ORRI principles in defining, funding, conducting, or utilizing research outcomes within their economic, social, or political activities. Whether at the community, regional, national, or international level, the guide is relevant to a diverse array of individuals and organizations, covering various sectors and interests. . Four interest groups are noted as follows:

1. Higher educational sector and Research Institutions. They bear the responsibility not only for the integrity and quality of their work but also for ensuring accountability in their methods, processes, and the dissemination of outcomes. By embracing ORRI principles, they can enhance public trust in science, contribute to solving real-world challenges, and ensure that their work benefits the broader community while adhering to the highest standards of professionalism and social responsibility.
2. Business sector and supporting agencies involved in conducting research or those engaged in designing, producing, procuring, or distributing products and services derived from research. This group includes commercial enterprises and their investors, whose operations are often guided by the pursuit of profit. Their capacity to reinvest in research and innovation, along with their efforts to maintain employee commitment, motivation, and well-being, is essential for sustaining their competitive edge and contributing to broader societal benefits. ORRI emphasizes the importance of balancing commercial goals with ethical considerations, social responsibility, and long-term sustainability.
3. Government sector, professional bodies and associations that focus on the competencies, expertise, and ethical conduct of researchers and innovators play a crucial role in the R&I ecosystem. These organizations act as custodians of quality standards in research and innovation, ensuring that practitioners adhere to best practices and ethical guidelines. By setting benchmarks for professional conduct and fostering a culture of excellence, they safeguard the integrity of the research process and its outcomes, benefiting both their members and the broader community. Government through the policymakers and strategists, along with the regulatory bodies, are responsible for establishing the frameworks that guide research, innovation, and related activities. These entities have the task of ensuring that legislation, standards, and guidelines are designed to support and promote the principles of ORRI. Their

role is to create an environment where research and innovation can thrive while remaining aligned with societal values, ethical considerations, and long-term sustainability goals.

4. Individuals, citizens, and communities advocating on behalf of a broader interest group. They are the most vulnerable to potential harm if commercial activities are pursued without ethical considerations. This makes their engagement and representation crucial in shaping research and innovation practices that prioritize public well-being and social responsibility.

The first three interest groups consist of those who, individually or collaboratively, are involved in defining, funding, conducting, or directly benefiting from research and innovation. This includes research funders, whether they operate as commercial entities or not, and in some cases, these funders are also involved in delivering goods and services derived from research outcomes. The fourth group encompasses a broader audience of individuals who are impacted by the results of research and innovation in their roles as consumers and citizens, both for their immediate benefit and for the well-being of future generations.

The guide serves as a valuable tool for individuals and organizations seeking to evaluate or modify the ways in which they commission, conduct, or utilize research to drive innovation. It enables stakeholders to foster an environment where researchers and other actors can reflect on their personal, collective, or organizational ethical values, understand how these align with the communities and cultures in which they operate, and integrate reflexivity throughout the research process. This guide demonstrates that ORRI is relevant to all interest groups and suggests specific actions for both organizations and individuals involved in or concerned with research and innovation. It highlights the key elements of ORRI as preconditions for ethical and responsible practices, encouraging researchers and institutions to integrate these principles into mission statements, strategies, and operational processes, such as branding, training, and job descriptions. Transparency in reporting research outcomes, including their social, economic, and environmental impacts, is emphasized as essential.

Chapter 2: ORRI in the Balkan Context

2.1 Overview of R&I Systems in the Western Balkan countries

Although the WB countries aim to develop their economies through research and innovation, economic growth remains sluggish, and mechanisms for effective technology transfer are yet to be established. The development of R&I systems is closely tied to the broader socioeconomic, political, and institutional structures of these countries. Rather than integrating R&I into industry effectively, research and development (R&D) efforts are often conducted for the industry rather than in collaboration with it. This disconnect is a key factor limiting the efficiency of R&I systems and poses a significant obstacle to building knowledge- and innovation-driven economies.

According to the (Fedajev, A.&Panik, M., 2024), a major impediment to the advancement of research and innovation systems in the WB region is the absence of comprehensive R&D and innovation policy tools, measures, and frameworks. Governments often lack a clear understanding of research and innovation principles as promoted by the European Commission, particularly the ORRI approach. Transparent, continuous monitoring and evaluation mechanisms for managing R&I policies and programs are critically needed, yet such systems remain largely absent. There are no established clear criteria dedicated to assessing progress in science, technology, and innovation. Additionally, the ongoing loss of highly educated researchers, innovators and professionals—commonly referred to as brain drain—continues to undermine efforts to sustain and strengthen the scientific community, further hindering the region's capacity for innovation.

North Macedonia is categorized as an Emerging Innovator according to the European Innovation Scoreboard (EIS) 2023, with an innovation performance at 46.3% of the EU average. This is below the average for other Emerging Innovators (54.0%). However, the country has seen slight progress, improving from 45.6% in 2022 and achieving a significant 14.5% growth since 2016, which surpasses the EU's average increase of 8.5%. In 2022, North Macedonia's GERD was 0.38% of GDP, but the distribution of GERD by sector and funding sources highlights certain challenges. The government is the primary source of R&D funding, accounting for 47.55% of GERD in 2021. A large proportion of funding (73.92%) comes from public sources, including the government and the higher education sector (HES). Private sector funding for R&D was only 20.59% of GERD, and the share of Business Enterprise Expenditure on R&D (BERD) fell to 22.00% in 2021, down from 30.57% in 2018. Higher education is the leading sector for R&D activity, contributing 66.40% of GERD, while the non-profit sector's share was just 1.2%, with most of its funding (97%) originating from international sources. The government and higher education institutions in North Macedonia are actively promoting ORRI principles within their R&D and innovation activities. However, the non-profit research sector has yet to engage in efforts to raise awareness or adopt ORRI principles among its organizations. According to the ERA Country report 2023 for the North Macedonia, published by the European Commission (EC), the country has committed to several European Research Area (ERA) actions, including promoting open access to research outputs and knowledge reuse through the European Open Science Cloud (EOSC), advancing gender equality in line with the Ljubljana Declaration, safeguarding academic freedom in Europe, and accelerating the green and digital transition in key industrial ecosystems. In 2021, North Macedonia established the National Open Science Cloud initiative (NOSCI.MK) with the goal of representing national perspectives in EOSC governance and contributing to policy development for Open Science (OS). NOSCI.MK is part of the National Initiatives for Open Science in Europe (NI4OS Europe) and aims to significantly contribute to the EOSC service portfolio. As of November 7, 2023, Scopus reported 6,415 Open Access publications from the country. Of these, 2,955 were classified as Gold Open Access, 603 as Hybrid Gold, 1,693 as Bronze, and 4,184 as Green Open Access. The number of Open Access publications increased significantly, with 1,404 published in 2022, representing a 34.7% rise compared to 2019. Although no specific R&D-focused measures addressing gender equality have been implemented, the country has enshrined gender equality as a constitutional principle. The Law on Equal Opportunities for Women and Men (LEO), amended in 2014, alongside the Strategy on Gender Equality 2022-2027 and its associated Action Plan for 2022-2024, outlines the commitment to promoting equality across public and private sectors as well as decision-making bodies.

Serbia is classified as an Emerging Innovator on the EIS, with innovation performance at 63.2% of the EU-27 average. The country's innovation capabilities are improving at a faster rate than the EU average, with an increase of 8.5 percentage points, placing Serbia above the average performance level of other Emerging Innovators. According to the ERA Country Report 2023 published by the EC, Serbia has made significant strides in aligning with ERA priorities, particularly in open science and gender equality. The adoption of the Open Science Platform in 2018 and active participation in the European Open Science Cloud (EOSC) have led to the rapid expansion of institutional repositories and the creation of two national portals: the National Open Data Portal and the National Open Science Portal. Progress in gender equality has also been evident, with the proportion of female researchers in Serbia rising to

52.3% by 2021. However, investment in R&D remains lower than the EU average. In 2021, Serbia's Gross Domestic Expenditure on R&D (GERD) stood at 0.99% of GDP, compared to the EU average of 2.26%. The country also lags in researcher density, with 789.4 researchers per million inhabitants (in full-time equivalents) compared to the EU average of 4,483.4. BERD as a percentage of GDP is 0.4, significantly below the EU average of 1.49%. To strengthen research and innovation, Serbia has established the Innovation Fund (IF) through collaboration with international financial institutions, organizations, donors, and private sector stakeholders. This initiative provides critical support to R&D activities, fostering innovation and encouraging the development of the country's innovation ecosystem.

According to the EIS 2023, **Albania** is categorized as an Emerging Innovator, with an overall innovation performance at 41.1% of the EU average, falling below the average for countries in the same category. Although Albania's performance is improving, its growth rate lags behind the EU's, resulting in a widening performance gap relative to the EU. According to the EC publication ERA country report 2023 for Albania, the country has made progress in aligning with the ERA Policy Agenda for 2022-2024, which includes nine key ERA actions, such as (1) enable Open Science, including through the European Open Science Cloud (EOSC); (2) Propose an EU copyright and data legislative framework for research; 3) Reform the Assessment System for research, researchers and institutions; 4) Promote attractive research careers, talent circulation and mobility; 5) Promote gender equality and foster inclusiveness; and 6) Protect academic freedom in Europe. While Albania has made strides in some of these areas, there is still significant work to be done. In terms of Open Science, Albania's government is planning to develop a platform to promote its adoption. Data from Scopus in 2023 indicates that of 4,043 total publications in Open Access, 1,918 (47%) fall under the Gold category, while 2,470 (61%) are in the Green category. However, despite consistent economic growth, Albania's progress in innovation remains limited. The nation faces several barriers, including inadequate infrastructure for R&D, weak collaboration between the public and private sectors, insufficient public and private investment in R&D, a shortage of skilled researchers and entrepreneurial capacity, and minimal private sector engagement in research activities. Albania also struggles to integrate the three elements of the Triple Helix model—education, research, and innovation—which weakens the synergies needed for a robust knowledge-based economy. Strengthening collaboration between these sectors is essential for fostering social and economic development. While higher education, scientific research, and innovation are critical drivers of progress, Albania's corporate sector remains largely inactive in R&D. Additionally, businesses in Albania are not adequately exposed to global competition, and government efforts to address this gap have been insufficient. The absence of a strong culture of innovation, coupled with the lack of applied ORRI principles in research and innovation, further hampers Albania's ability to achieve its full potential in fostering a dynamic, knowledge-driven economy. Building stronger public-private sector linkages and promoting an innovation-oriented mindset across institutions and businesses are critical steps toward overcoming these challenges.

Bosnia and Herzegovina (BiH) has made modest progress in implementing the ERA priorities, including adopting Open Science principles, engaging with European Open Science Cloud (EOSC) initiatives, and advancing Gender Equality programs. Efforts have also been made to promote attractive research careers and enhance international collaboration. According to the EIS 2023, BiH is classified as an Emerging Innovator, with innovation performance at 36.2% of the EU average, which is below the average for other Emerging Innovators. Unfortunately, this performance is declining, widening the gap to the EU average. One contributing factor is the lack of an appealing environment for innovators in the country. Limited investment in R&I from the private sector further reduces innovation outputs, even relative to the level of investment made. According to the ERA Country report 2023 for Bosnia and Herzegovina, published by the EC, in 2022, Bosnia and Herzegovina's Gross Domestic Expenditure on Research and Development (GERD) amounted to 0.19% of GDP. The distribution of GERD among sectors was as follows: higher education accounted for 56.5%, the business sector contributed 38.6%, and the government sector only 4.9%. On a positive note, the country's largest universities have established an Open Access repository for academic publications and introduced a "Policy of Open Access to Scientific Research Infrastructure" to support Open Science initiatives. An analysis by the United Nations Development Program (UNDP) on the Gender Development Index (GDI) categorized BiH as having medium equality in Human Development Index (HDI) achievements between women and men in 2021. However, the overall innovation system in BiH faces significant challenges, operating in an unfavorable social, political, economic, and legal environment that limits its capacity to effectively serve the needs of its people and the state (Fedajev, A.&Panik, M., 2024).

As reported by the EIS 2023, **Montenegro** is classified as an Emerging Innovator, achieving 47% of the EU-27 average innovation performance. While the country has shown improvement, its growth rate remains slightly below that of the EU-27 and lags behind the average for other Emerging Innovators. Consequently, the gap between Montenegro's innovation performance and the EU-27 average has widened in recent years. According to the ERA Country report 2023 published by EC, Montenegro has not yet formally committed to the actions outlined in the ERA Policy Agenda, but its R&I policies are gradually aligning with ERA priorities. In 2021, the country's GERD was 0.5% of GDP, with BERD accounting for 0.2% of GDP. Montenegro also participates in the European Open Science Cloud (EOSC), though its involvement remains limited. Nonetheless, the country aims to strengthen European collaboration in managing and sharing research data. Despite these efforts, overall investment in research and development remains modest.

Despite increased efforts in recent years to prioritize R&I and implement the actions outlined in relevant reports, according to the ERA Country report 2023 published by EC, **Kosovo** has made limited and incomplete progress in adopting the ERA Policy Agenda. The slow advancement in this area is largely attributed to fragmented planning and implementation efforts by the government, stemming from the absence of a comprehensive roadmap for developing a national R&I framework. Although the legal framework commits to allocating 0.7% of the Government Budget Allocations for R&D annually, actual funding remains significantly lower, at just 0.1% of the national budget, leaving research activities severely underfunded. Kosovo's alignment with ERA priorities is progressing at a gradual pace. The country's commitment to integration with the ERA is largely driven by bilateral agreements with the European Union, including the Stabilization and Association Agreement (SAA) and participation in Horizon Europe. However, collaboration between academic institutions and industrial stakeholders remains minimal. To address this gap, the government should actively promote joint initiatives involving triple and quadruple helix collaborations to encourage private sector investments in R&I through adoption of ORRI principles. The Country report 2023 shows that Kosovo is in the early stages of advancing Open Access in R&I. The country is not yet included in databases such as Scimago, OpenAIRE, Scopus, or Pasteur4OA, making it difficult to track the number of open access publications by Kosovar researchers. On a positive note, Kosovo has recently updated its legal framework for intellectual property rights (IPR), marking a step toward improving the regulatory environment for research and innovation.

2.2 Socio-economic and Cultural Challenges

The ORRI approach has evolved over time, emphasizing the need to address societal challenges as a core objective of scientific research. It also outlines the methods necessary to achieve this goal. ORRI focuses on upholding rigorous ethical standards in research, ensuring gender equality within the scientific community, holding policymakers accountable for mitigating the potential negative impacts of innovation, and actively involving communities affected by these innovations. It also promotes public understanding through enhanced science education and Open Access to research outcomes.

The WB countries—Albania, Bosnia & Herzegovina, Kosovo, Montenegro, North Macedonia, and Serbia—are economies in transition and have been striving for European Union membership for many years. Policymakers in these countries increasingly recognize the critical role of research and innovation in fostering economic development, particularly in the aftermath of major global market disruptions. Like other nations, WB countries aim to improve the performance of their national research and innovation systems by implementing research and innovation policies, which are now key tools for enhancing global competitiveness. To design effective policies and ensure their efficient implementation, policymakers require reliable, comprehensive, and comparable data on the state of research and innovation capabilities and performance in their own and other countries. Learning from the experiences of others can provide a valuable foundation for benchmarking and improving their strategies. In response to these needs, various international organizations have begun assessing and ranking countries based on their research and innovation potential. Report such as European Innovation Scoreboard (EIS) is among the most prominent tools used to measure national research and innovation performance. This annual report consolidate data from various economies and present the results through composite indices, providing valuable insights into global innovation capacity.

Quadruple Helix stakeholders must work together to support specialized professionals who operate at the intersection of research and innovation, such as co-design facilitators and science communicators. Currently, the understanding and adoption of co-creation processes need significant improvement across all sectors targeted by ORRI. There is also limited awareness about implementing citizen science initiatives, gender equity practices and ethical values in various R&I domains, including managing open data, creating open educational resources, and addressing ethical governance issues.

2.3. Current Research gaps and Brain Drain Issues

The quality of higher education and the development of science and technology are vital prerequisites for progress in research and innovation. Higher education quality is often assessed based on university rankings, such as the Shanghai University List, which considers scientific achievements such as the number of publications in SCI-listed journals, citation rates, and the inclusion of scholars among the top 500 globally. Besides two Serbian's Universities, the rest of the WB universities are not ranked among the first 1000 universities on the Shanghai University List 2024. The main reasons for these low ranks of the WB higher educational institutions is the underfunding the higher educational sector, inadequate investment and inconsistent reforms in the higher education along with the weak collaboration between universities and industries.

Furthermore, the Western Balkans have faced a significant challenge as a net exporter of human resources. On a global scale, the WB countries rank among the countries most affected by brain drain. According to (Icoski,M., 2022), youth brain drain is one of the most worrisome problems for the WB countries, since they are ranked among the top brain drain leaders in the world, with estimations to lose a quarter to half of its skilled and educated young citizens in the forthcoming decades. Furthermore, in the last three decades, due to massive emigration and brain drain phenomena, Serbia has lost 9% of its citizens, North Macedonia 10%, Bosnia and Herzegovina 24%, and Albania 37%. The Global Economy's Human flight and brain drain index[1], which is in the range 0 (lowest) to 10 (highest), is 6.5 for North Macedonia for 2024, 5.9 for Serbia, 8.3 for Albania, 7.2 for Bosnia and Herzegovina, 5.4 for Montenegro and . These migration patterns have a profound impact on the research and innovation capacities of the region, as human resources are widely recognized as a critical driver of progress in these areas, both for individual companies and the broader economy. Key factors driving this migration include higher wages in wealthier countries, better working conditions, and enhanced opportunities for professional growth abroad. Addressing this issue requires greater investment in human capital, a crucial element for fostering economic growth and development in the region. However, limited funding availability in these economies exacerbates the issue, leaving them with insufficient resources to develop the human capital necessary for advancing research and innovation.

A supportive business environment and stable political environment are also essential and crucial for creating a favorable climate for research and innovation and fostering innovation. To stimulate economic growth under these circumstances, WB countries must focus on enhancing conditions for innovation, prioritizing measures that require minimal financial resources. However, an analysis of research and innovation in the WB region reveals significant challenges. The available data shows that WB countries lag significantly behind selected EU member states in innovation performance. According to (Fedajev, A.&Panik, M.,

[1] https://www.theglobaleconomy.com/Macedonia/human_flight_brain_drain_index/

2024), unlike in the EU, where there is a strong linear relationship between innovation and competitiveness, no statistically significant correlation exists between these factors in the WB. Furthermore, there is also no meaningful correlation between innovation inputs and outputs in the WB, contrasting sharply with the EU, where such relationships are robust and statistically significant. This highlights the need for targeted strategies to address these gaps and enhance the region's innovation ecosystem along with the promotion and adoption of ORRI principles.

The WB face a significant gap in the adoption and application of ICT compared to EU countries, highlighting their lag in developing a knowledge-based economy and an information society. This gap continues to widen as the region struggles to establish the foundation for "smart growth," largely due to underdeveloped ICT infrastructure. The overall quality of infrastructure in the WB remains far below the EU average. Although investments in infrastructure have increased over the past two decades, they remain insufficient to close the gap with EU countries or to fully support the research and innovation needs of these economies.

2.4. Opportunities and recommendations for ORRI Integration

The WB economies have yet to develop robust innovation ecosystems, and stronger collaboration is needed between key sectors, such as academia and industry. Improvements in these relationships must be driven by cooperation, mutual learning, the adoption of ORRI principles, and ensuring clear benefits for all stakeholders. It is crucial to leverage existing opportunities to build trust, foster stronger connections, and enhance networking across various sectors.

In addition to introducing ORRI principles and fostering discussions at the national level, local governments and civil society organizations have an essential role in embedding these principles within specific regions to ensure long-term sustainability. Their active participation in ORRI networks is critical, and they should be motivated to develop authentic interest and fully engage in the process. Furthermore, intergovernmental and international organizations play a vital role in promoting a regional approach and identifying key priorities. Their support is essential for establishing working groups that address important issues such as increasing women's participation in STEM (science, technology, engineering and mathematics) fields or advancing open science initiatives.

Governmental stakeholders must enhance their readiness to participate in collaborative and innovative processes, adopting creative approaches and minimizing administrative and bureaucratic barriers. They should actively promote the adoption of ORRI principles, advancing gender equality, diversity, and inclusivity, while engaging in mutual learning initiatives. Legislative and regulatory frameworks must be designed to support ORRI practices, including facilitating access to and reuse of data and scientific results, as well as addressing issues like gender-based violence.

Funding and support schemes in WB countries should integrate ORRI aspects such as ethics, open standards, and gender equality into the evaluation, selection, and monitoring processes. Financial backing should also be extended to initiatives that bring research and innovation closer to citizens. Additionally, non-academic stakeholders should be systematically included in decision-making bodies within the research and innovation ecosystem to foster inclusivity and diverse perspectives.

The successful implementation of ORRI depends on the active involvement of stakeholders across all sectors of the QH, including universities, research centers, academies of sciences, scientific networks, and independent researchers. Their collective efforts are crucial to driving meaningful changes at both institutional and individual levels.

Research-performing organizations should cultivate an institutional culture grounded in ORRI principles, such as upholding academic integrity, ethics, inclusiveness, and active participation in scientific discussions and events. These institutions should prioritize networking with all QH stakeholders and ensure that support staff provide practical assistance in areas like public engagement, outreach, the development of open resources, inclusion of marginalized groups, and promoting open access to research outcomes. Research and academic institutions should make their infrastructures more accessible by providing clear guidelines on how stakeholders can engage. The establishment of open science and open access infrastructures requires a well-defined allocation of responsibilities for their upkeep and should leverage opportunities provided by EU initiatives such as the European Research Infrastructure Consortia (ERIC), the European Strategy Forum on Research Infrastructure (ESFRI), and the European Open Science Cloud (EOSC).

Since the professional development and training programs focused on ORRI principles and co-creation methodologies are crucial, they should be incorporated into academic curricula as well as ongoing professional education programs for staff members. Policymakers in WB countries are also advised to enhance the promotion of ORRI principles by incorporating additional criteria into the accreditation processes for study programs. This step would ensure a more structured and widespread adoption of these principles across the region's educational and research institutions.

The private sector also has a vital role to play in promoting awareness of ORRI principles. Companies of all sizes, including start-ups, should be actively involved in participatory processes. The integration of ORRI principles should become a core part of corporate culture, with systematic consideration of the social dimensions of technological development and innovation, framed within a context of social responsibility and a human-centered approach. Public concerns and citizen feedback should be integral to these discussions. The private sector must prioritize specific ORRI principles, such as achieving gender equality in leadership roles, supporting women in business research and innovation, and fostering networks for female entrepreneurs. Ethical practices and standards in business research and innovation should also be strengthened to align with ORRI objectives.

Civil society organizations (CSOs), including community groups, labor unions, private charities, foundations, and both national and transnational non-governmental and non-profit organizations (NGOs and NPOs), play a critical role in advancing ORRI principles. To fulfill this role, CSOs must stay informed about scientific developments and actively utilize scientific evidence to achieve their goals. The outcomes of research and innovation should be made accessible to individual citizens and civil society actors, enabling them to bridge the gap between scientific knowledge and the broader public. CSOs are vital in mobilizing diverse communities and encouraging their participation in public discussions and decision-making panels. Additionally, CSOs should consider sharing their data with researchers, making their publications available in open repositories, and contributing to scientific discourse by publishing in journals or co-authoring research articles.

Open science emerged several decades ago as a movement aimed at transforming scientific practices to address the challenges of the digital age and enhance the societal impact of science. Providing broader and more open access to research processes and outcomes improves the efficiency of scientific systems, reduces costs associated with data collection, creation, and reuse, and amplifies the social impact of science. While many WB countries have developed open science policies or are involved in EU initiatives promoting open science, there is a strong need for all countries in the region to adopt or enhance their national policies based on ORRI principles. A common gap in the region is the lack of actionable plans and sufficient resources to implement open science practices for researchers. Therefore, it is essential that policies clearly outline how the infrastructure necessary for open science will be provided and sustained.

Open science introduces numerous innovative practices and principles, such as the FAIR (Findable, Accessible, Interoperable, and Reusable) data framework, Data Management

Plans, open code, open software, and citizen science initiatives. Currently, WB researchers primarily gain knowledge about these practices through participation in EU projects and related educational programs. Some educational resources, such as *Otvorena nauka: praksa i perspektive* and *Vodič za građansku nauku*, have been developed and published in Serbia. However, it is crucial to ensure that young researchers across the WB have unrestricted access to education on these transformative trends and ORRI principles in science. Integrating these new research practices into curricula at all educational levels is highly recommended.

Chapter 3: Case Studies and Success stories

3.1 ORRI best practices in WB countries

3.1.1 Five different territories with RRI anchor activities through the WBC RRI.NET project

The Horizon 2020 project Responsible Research and Innovation in the Western Balkans (WBC RRI.NET) fosters the application of Responsible Research and Innovation (RRI) at the territorial level, with different RRI dimensions, distributed in the following five Western Balkan Research and Innovation (R&I) ecosystems:

- **Albania: Citizen Science and governance in Kune-Vain Lagoon;**
- **Republika Srpska (Bosnia and Herzegovina): Advancing R&I Ecosystems through adoption of Ethics, Science Education and Open Access;**
- **Montenegro: Aligning RRI with S3 Goals through Public engagement and Governance;**
- **North Macedonia: Addressing Digital and Gender Challenges in Skopje through adoption of Science Education and Gender Equality;**
- **Serbia (Autonomous Province of Vojvodina): Connecting Science, Industry, and Society through Public Engagement and Open Access.**

The initiatives are drawn on the input of the co-design process, with the ultimate goal to consequently trigger RRI-driven institutional and territorial transformations. They also promote a multi-level governance framework for steering R&I in the Western Balkans.

The WBC-RRI.NET project successfully facilitated over 30 cross-sector workshops involving academia, policymakers, and civil society. These workshops resulted in actionable recommendations that were integrated into regional innovation policies. Specific initiatives are being carried out within various beneficiary organizations, focusing on areas such as gender equality, ethics, public participation, science education, and open access. These efforts are tailored to fit within regional and local governance frameworks and decision-making systems. Their long-term impact can be gauged by transformative outcomes beyond the project's duration, such as implementing innovative decision-making practices, formulating business strategies, establishing cooperative agreements, and enacting institutional reforms within the involved organizations. The details of the initiatives are presented in the next section.

Albania: Citizen Science and governance in Kune-Vain Lagoon

In Albania, the WBC-RRI.net project focuses on a pilot citizen science initiative in the Kune-Vain lagoon, a critical natural ecosystem in Lezha known for its unique biodiversity and potential for sustainable tourism. However, this area is under significant strain due to urban expansion and the impacts of climate change. The initiative introduces a participatory approach to evaluating ecosystem services, including flood mapping, to deepen understanding of climate vulnerabilities. Additionally, it aims to strengthen collaboration between decision-makers and local stakeholders, empowering the quadruple helix network in Lezha. This marks the first application of such an evaluation method in Albania, integrating RRI principles to enable informed governance of shared resources and embedding a scientific framework into local decision-making processes.

Republika Srpska (Bosnia and Herzegovina): Advancing R&I Ecosystems through adoption of Ethics, Science Education and Open Access

In Republika Srpska, the project aims to enhance the research and innovation ecosystem through the gradual integration of RRI principles. While positive developments are evident at both policy and practice levels, opportunities for further improvements remain. The expected outcomes of the WBC-RRI.net activities include:

- Incorporating RRI elements into at least one grant scheme managed by the Ministry of Scientific and Technological Development, Higher Education, and Information Society of Republika Srpska.
- Advancing gender-sensitive teaching in STE(A)M disciplines across a minimum of five secondary schools.
- Introducing Gender Equality Plans and improving ethical standards and open access practices in at least two higher education institutions.

Montenegro: Aligning RRI with S3 Goals through Public engagement and Governance

As the first non-EU country to adopt the Smart Specialization Strategy (S3), Montenegro is uniquely positioned to merge RRI principles with S3 objectives. Project activities focus on shaping public policy instruments, structuring research initiatives, and establishing funding mechanisms that contribute to sustainable innovation ecosystems. This integration is intended to align RRI principles with environmental goals and S3 priorities, ensuring that future developments support both scientific and societal advancement.

North Macedonia: Addressing Digital and Gender Challenges in Skopje through adoption of Science Education and Gender Equality

Skopje faces a pressing need for IT specialists, even as ICT is identified as a horizontal priority in North Macedonia's S3 framework. To tackle this challenge, the project adopts a multidisciplinary approach that incorporates science into education while emphasizing creativity and cultural dimensions. Additionally, gender equality remains a critical focus, as women's representation in STEM—particularly in ICT—remains low. The initiative aims to reduce gender disparities, promote societal inclusion, and support the professional development of female entrepreneurs, all while addressing the region's digital transformation needs.

Serbia (Autonomous Province of Vojvodina): Connecting Science, Industry, and Society through Public Engagement and Open Access

In Vojvodina, the project prioritizes strengthening connections between scientific institutions, the industrial sector, and society, fostering public engagement with RRI. A key initiative is the broader adoption of the BE-OPEN open repository, creating a freely accessible knowledge platform to drive societal progress. This initiative aims to cultivate a self-sustaining research and innovation ecosystem, contributing to long-term development and collaboration across sectors.

3.1.2 ORRI practices in WB countries

The Balkans have made significant strides in adopting ORRI principles, driven by regional collaborations and initiatives that emphasize transparency, public engagement, and inclusive governance. These advancements reflect a broader shift toward open, ethical, and participatory research practices across the region. Several key examples highlight the positive impact of ORRI initiatives. The WBC-RRI.NET project stands out as a major regional effort in the Western Balkans, fostering collaboration among academia, civil society, and policymakers. This initiative promotes open science and responsible innovation by encouraging practices such as public consultations to set research priorities, open-access publishing, and community-driven research agendas. The success of WBC-RRI.NET demonstrates how cross-sector partnerships can create inclusive research ecosystems that address societal needs, particularly in areas such as health, environmental sustainability, and education.

In addition to regional projects, several national initiatives have also achieved notable progress. In Kosovo, institutions such as the Kosovo Academy of Sciences and Arts and Open Data Kosovo have led efforts to make research data more accessible to the public. These initiatives have supported the opening of government data, enabling researchers and policymakers to base decisions on transparent, up-to-date information. Similarly, Serbia’s STAR Center has championed open science policies and citizen science projects, encouraging public participation in scientific activities. By involving citizens in research, Serbia is fostering more inclusive and participatory research practices, aligning with ORRI's core values.

Despite these successes, challenges persist, particularly regarding the institutional frameworks and infrastructure necessary to fully support ORRI. While individual researchers and institutions have increasingly embraced ORRI principles, comprehensive policies for the open sharing of data and research outputs across government and non-government sectors are still lacking. Additionally, local NGOs and municipalities face significant barriers, such as limited technical capacity and inadequate resources, which hinder their ability to fully implement ORRI practices.

Addressing these challenges requires sustained capacity-building efforts, including training programs for researchers and policymakers and the establishment of robust national-level ORRI frameworks. Nevertheless, the progress achieved so far provides a clear roadmap for expanding ORRI practices in the Balkans. By fostering regional cooperation, strengthening infrastructure, and investing in capacity-building, the region can continue to advance toward a more open, ethical, and inclusive research environment. The following section outlines several best practices for adopting ORRI in Western Balkan countries.

Open Science Practices through Co-PLAN, Zenodo and DASS platforms

Several institutions in the Western Balkans have made significant progress in adopting Open Science principles, a core component of ORRI. Open Science emphasizes the accessibility of research outputs, data sharing, and collaborative engagement, reflecting the broader goals of transparency and inclusivity. In Albania, the organization **Co-PLAN** stands out as a key player in sustainable development research. By maintaining a public repository, Co-PLAN ensures that research outputs on urban governance and sustainability are readily accessible to both the public and policymakers. This initiative aligns closely with ORRI’s emphasis on transparency and civic engagement. Additionally, Albanian researchers increasingly utilize European platforms like **Zenodo** to publish their work. However, the high costs associated with Article Processing Charges (APCs) present a significant financial barrier, highlighting the need for institutional or governmental support to enable broader participation.

The use of Zenodo, a widely recognized open-access repository, extends beyond Albania to researchers in Bosnia and Herzegovina and Montenegro. This platform allows academics to share articles, datasets, and other research products freely, fostering collaboration and knowledge dissemination across the region.

In Bosnia and Herzegovina, the **Data Archive for Social Sciences (DASS)** has played a pivotal role in centralizing research data, particularly within the social sciences. However, accessing datasets or publications from the DASS collection often requires submitting a formal request. While the platform showcases valuable resources and research, explicit download permissions or clear instructions for accessing full materials are not directly provided, which may pose a barrier to immediate usability.

These examples highlight both the successes and challenges in advancing Open Science across the Western Balkans. Addressing financial and procedural barriers will be key to further fostering openness, accessibility, and collaborative engagement in the region.

STAR Center (Serbia) and Balkan Scientific Network promotes Citizen Science and Public Engagement

A key principle of ORRI is enhancing public participation in research processes, which is increasingly being achieved through citizen science initiatives. In Serbia, the **STAR Center** has been a leading force in developing Open Science policies while actively involving the public in scientific activities. These efforts not only promote transparency in research but also encourage citizens to actively engage in scientific inquiry. At the regional level, initiatives such as the **Balkan Scientific Network** have emerged to foster collaboration among researchers across the region. This network facilitates the sharing of research findings, methodologies, and best practices, strengthening scientific cooperation in the Balkans.

The **STAR Center** has made significant contributions to Open Science in Serbia by implementing citizen science initiatives and developing supportive policies. The center has facilitated public engagement through calls for citizen science projects, fostering collaboration between researchers and the public on diverse topics such as biodiversity, public health, cultural heritage, and sustainable development. Notably, the STAR Center has funded projects through open calls, supporting 127 proposals across Serbia in 2024.

Additionally, the center's initiatives have engaged over 1,000 citizens in participatory research projects. These efforts have resulted in the identification of more than 50 environmental hazards and the implementation of mitigation measures in three municipalities, demonstrating the tangible benefits of public participation in scientific research.

Through these initiatives, the STAR Center exemplifies how citizen science can enhance research transparency, foster public engagement, and address societal challenges, aligning with the core values of ORRI.

National Repositories in Serbia

Serbia showcases one of the most robust systems for implementing ORRI in the Western Balkans. The **National Repository of Dissertations (NaRDuS)** integrates repositories from multiple universities, including Belgrade, Novi Sad**,** and Niš, offering a comprehensive platform for accessing academic research.

In addition, specialized repositories such as the **National Repository of Agricultural Education (CaSA)** focus on thematic research areas like sustainable agriculture, further highlighting Serbia's commitment to targeted knowledge dissemination. These systems exemplify how a centralized approach can significantly enhance research accessibility, foster collaboration, and drive innovation across various disciplines.

3.1.3 Case Study: Promoters of ORRI practices in Kosovo

Kosovo has made notable progress in integrating ORRI principles over the past decade. The Kosovo Academy of Sciences and Arts has played a pivotal role by prioritizing the digitization and archiving of research outputs. These efforts ensure the preservation of research materials while making them accessible to the broader public, fostering transparency and collaboration within the scientific community. Individual researchers in Kosovo have also embraced ORRI principles by publishing their work in open-access journals, reflecting an organic alignment with values of openness and accessibility and demonstrating growing awareness and commitment within the academic community.

Despite these advancements, Kosovo still faces challenges in developing comprehensive institutional frameworks to fully support ORRI. Key gaps include the absence of robust policies to promote open science, a lack of dedicated infrastructure, and limited sustainable funding mechanisms. Addressing these issues will require strategic action, including the development of supportive national policies, investment in research infrastructure, and the establishment of funding schemes to sustain long-term efforts toward ORRI adoption.

In the public sector and among NGOs, the adoption of ORRI principles is essential for fostering transparency and accountability. Municipalities, as key components of Kosovo's public administration, are well-positioned to implement these principles. However, while municipalities often have access to valuable data that could be shared with the public, they frequently fail to make this information available. This lack of data accessibility hinders the development of open research practices, as researchers and stakeholders cannot rely on up-to-date or comprehensive local governance data. A common issue is the absence of specific, organized datasets at the municipal level. Although such data could greatly support local research, it is either not made publicly available or is presented in formats that are inaccessible to the public. This lack of openness restricts researchers' ability to produce studies grounded in accurate, reliable data.

Local NGOs face additional challenges in implementing ORRI principles. Many organizations lack the technical capacity to manage, organize, and publish open data. A significant number of NGOs do not have dedicated websites or platforms to share their findings, reports, or updates with the public. Furthermore, many NGOs underutilize social media and other digital tools to promote their research and initiatives, limiting the visibility and accessibility of their work. These resource and capacity constraints prevent local NGOs from fully adhering to ORRI principles, reducing their contributions to open research and knowledge sharing within their communities.

Another critical aspect of ORRI is enabling **evidence-based decision-making** through open and transparent data. However, most local organizations, including municipalities and NGOs, do not prioritize research as a central part of their operations. As a result, access to reliable data for decision-making remains limited. Without accurate and comprehensive information, decisions are often based on incomplete or outdated data, hindering the development of effective, evidence-driven policies. This failure to integrate research into decision-making processes negatively impacts the ability of local governments and organizations to implement policies and projects that meaningfully improve community well-being.

Nevertheless, Kosovo's non-governmental sector includes several organizations that actively promote ORRI principles and advance research innovation practices. Key examples include the **Coalition of Civil Society Organizations for Human Rights (COHU)**, the **Institute for Development and Economic Policy (INDEP)**, the **Kosovo Democratic**

Institute (KDI), and **Open Data Kosovo (ODK)**. These organizations play a significant role in fostering transparency, open data practices, and collaboration, setting important examples for other institutions in the region.

COHU plays a pivotal role in promoting transparency, accountability, and human rights through its research and advocacy efforts. Focused on good governance and transparency, COHU emphasizes open research and data transparency by publishing reports and research findings related to governance, human rights, and anti-corruption initiatives. These reports are publicly accessible on their website and are widely disseminated through social media platforms, ensuring that important findings reach a broad audience. While COHU does not maintain a centralized data repository, it shares relevant information through publicly available reports and documents. Its active engagement on social media platforms further enhances public access to their work, helping to promote transparency and awareness. However, establishing a more structured open data platform, similar to Open Data Kosovo, could significantly improve accessibility to datasets and reports, further strengthening their alignment with ORRI principles.

INDEP is a prominent Kosovo-based research institute dedicated to fostering development and good governance through independent research and policy analysis. INDEP has made significant strides in advancing open research and data dissemination. The organization regularly publishes research and policy papers on key topics such as governance, the economy, and public policy, all of which are freely available on their official website under the publications section. This commitment to offering open access demonstrates INDEP's dedication to transparency and ORRI principles. In addition to sharing publications on their website, INDEP effectively uses social media platforms like Facebook and Twitter to disseminate research findings, updates, and event information. This proactive approach ensures that their work reaches a wider audience and fosters informed public discourse. By combining open-access research with strategic digital outreach, INDEP actively contributes to the principles of openness and accessibility in research.

KDI plays a significant role in advancing ORRI practices in Kosovo, particularly in promoting transparency and accountability in government operations. KDI's work aligns closely with key ORRI principles, including **open access to data**, public engagement, and evidence-based decision-making. One of KDI's flagship initiatives, the Transparency Index, monitors the openness of Kosovo municipalities in areas such as public procurement, budget transparency, and public access to official documents. By evaluating municipalities' performance in providing access to critical data—such as procurement contracts, budget amendments, and expenditure reports—KDI has significantly enhanced the visibility and accountability of local government operations. This initiative aligns with ORRI's emphasis on data accessibility and transparency, enabling researchers, journalists, and citizens to make informed decisions based on reliable, publicly available data. Moreover, KDI actively advocates for open data practices, encouraging both public sector entities and civil society organizations to share research, reports, and public documents openly. In addition to monitoring transparency, KDI prioritizes public engagement through its capacity-building initiatives. By providing training and resources, KDI enhances public understanding and involvement in local governance. These programs empower citizens and researchers to navigate and utilize government-provided data effectively, transforming them into active participants in decision-making processes. This aligns with ORRI's core principle of involving society in shaping research priorities and outcomes. KDI's efforts to promote greater data openness and transparency position it as a key player in advancing ORRI practices in Kosovo. By advocating for the publication of government spending data and procurement information, KDI ensures that citizens, researchers, and other stakeholders can access and analyze vital data. This fosters informed public discourse and academic inquiry—both essential components of ORRI. Through their continued work, KDI sets a strong precedent for open governance and transparent research practices in Kosovo. Their impact not only strengthens local accountability but also provides a model for other regions and sectors, further advancing the principles of Open and Responsible Research and Innovation.

ODK is dedicated to enhancing transparency and accountability in Kosovo through the promotion of open data. The organization focuses on providing access to public data and encouraging its use for research, civic engagement, and policymaking. As a prominent contributor to Kosovo's ORRI landscape, ODK advocates for open access to governmental and research data, significantly improving the transparency of public decision-making processes. ODK has developed tools and platforms to make data publicly available, including open data portals that empower citizens, researchers, and policymakers alike. By facilitating open and accessible data, ODK plays a vital role in implementing ORRI principles, fostering collaboration between government institutions, civil society, and research organizations. One of ODK's most impactful contributions has been the creation of a comprehensive platform that provides access to a wide range of datasets from government and public sector organizations. The organization has been instrumental in advocating for the opening of government data, ensuring it is accessible and usable for citizens, policymakers, and researchers. ODK also actively works to improve data collection, digitization, and data-sharing practices in Kosovo.

By offering easy access to data and resources, ODK is fostering open research and enabling data-driven decision-making. To date, the organization has successfully opened over 200 datasets across various sectors, empowering researchers and the public to analyze critical issues such as unemployment and healthcare access. Through its efforts, Open Data Kosovo has established itself as a **model organization** for advancing open data and fostering collaboration among key stakeholders. By improving accessibility and usability of public data, ODK continues to play a crucial role in promoting open research, civic participation, and evidence-based policymaking in Kosovo.

3.2 ORRI best practices in EU countries

While the Balkans have made commendable progress in adopting Open and Responsible Research and Innovation (ORRI) principles, a comparison with other regions highlights opportunities for further advancement. Scandinavian countries, such as Sweden, Denmark, and Norway, are global leaders in institutionalizing ORRI principles. Their success stems from the seamless integration of ORRI into public policy and **private-sector practices**, resulting in a cohesive, national approach to fostering openness, transparency, and innovation.

Key features of the Scandinavian strategy include:

- **Mandatory Open Access Policies**: National mandates require that all publicly funded research be published in open-access journals or platforms, ensuring broader accessibility to research outputs. This fosters transparency and enhances opportunities for collaboration. For instance, Sweden's commitment to **Plan S** ensures unrestricted access to publicly funded scientific publications, setting a high standard for open science practices.
- **Public-Private Partnerships and Innovation Incentives**: Scandinavian countries emphasize robust collaboration between government agencies, research institutions, and private industries. These partnerships are integral to large-scale innovation ecosystems, such as Denmark's Innovation Fund, which supports projects addressing societal challenges while aligning with sustainable development goals. To further encourage responsible innovation, governments provide tax breaks and funding incentives to companies that adopt open science practices, such as data sharing and public engagement. This approach motivates the private sector to align with ORRI principles, fostering a culture of transparency and inclusivity.

In the following paragraph, best practices from EU countries geographically close to the Western Balkans are presented.

Digital Repositories of the University of Zagreb (Croatia)

Croatia has actively embraced the principles of ORRI by fostering transparency, inclusivity, and collaboration within its research ecosystem. A significant component of this initiative is Croatia's participation in the European Open Science Cloud (EOSC), which aims to create a federated environment for sharing and accessing research data across Europe. Croatian academic and research institutions have made notable contributions to this effort, exemplified by the **University of Zagreb**, which has established **digital repositories** like its central repository system. These repositories archive and provide open access to diverse research outputs, including dissertations, research data, and publications.

By enhancing the accessibility of scientific knowledge, these digital repositories contribute to a more transparent and collaborative research culture. Moreover, Croatia actively supports collaborative projects that integrate citizen science, encouraging public participation in the research process. This approach aligns with the ORRI framework's emphasis on co-creation and societal engagement, ensuring that scientific advancements address broader societal needs. Such efforts not only demonstrate Croatia's adherence to European standards but also empower its research community to engage in cutting-edge, open, and ethical scientific practices.

National Strategy for Open Science in Slovenia

Slovenia has been at the forefront of advancing Open Science principles through the adoption of its **National Strategy for Open Science**. This strategy aims to create an environment where scientific research outputs, including data and publications, are openly accessible, fostering **transparency, collaboration**, and **innovation**. A key aspect of Slovenia’s approach is the integration of its research infrastructure with European and global initiatives through platforms such as **OpenAIRE**.

OpenAIRE, the European Open Access Infrastructure, connects Slovenian researchers and institutions to a broader international network, ensuring their work both contributes to and benefits from global Open Science efforts. This alignment supports compliance with **European mandates**, such as those under **Horizon Europe**, which require open access to research data and publications.

Slovenia also prioritizes inclusivity by ensuring that small institutions and individual researchers have access to the necessary tools and platforms for Open Science. This democratization of access helps reduce disparities within the global research community. A cornerstone of Slovenia’s strategy is the promotion of the **FAIR principles** (Findable, Accessible, Interoperable, and Reusable), which are essential for sustainable open access. By emphasizing the management and sharing of high-quality, reusable research data, Slovenia enhances the **national impact** of its research while strengthening its role in global scientific collaboration.

For continued progress, Slovenia can focus on expanding public engagement through citizen science, providing enhanced training for researchers on Open Science practices, and increasing funding to sustain its Open Access Infrastructure. These efforts will further solidify Slovenia's position as a leader in the Open Science movement while ensuring its research community remains at the forefront of innovation and collaboration.

Hellenic Data Service in Greece

The **Hellenic Data Service (HELIX)** is a major initiative in Greece designed to advance Open Science by providing a centralized platform for managing and sharing open-access research data. HELIX exemplifies the principles of ORRI by fostering transparency and ensuring that research outputs are accessible to not only the scientific community but also policymakers, industry stakeholders, and the general public.

The platform offers a well-organized infrastructure that enables researchers to share datasets in ways that facilitate **reuse** while adhering to the **FAIR principles** (Findable, Accessible, Interoperable, and Reusable). This approach supports the creation of high-quality, **open knowledge networks**, promoting effective collaboration across diverse disciplines. By making research data freely available, HELIX helps eliminate barriers to scientific progress and ensures that research findings remain **transparent** and **publicly accountable**.

Moreover, HELIX's open-access model encourages **collaboration** and **inclusivity** by allowing various stakeholders, including **citizen scientists**, to both contribute to and benefit from scientific discoveries. This openness strengthens connections between researchers and the broader community, enhancing public engagement with science.

Through HELIX, Greek researchers can better integrate their work into larger **international research and innovation ecosystems**, enhancing Greece's participation in global **Open Science initiatives**. By providing a robust, open platform, HELIX plays a critical role in fostering innovation, collaboration, and the transparent dissemination of scientific knowledge.

Promoting ORRI through the Executive Agency for Higher Education, Research, Development, and Innovation Funding (UEFISCDI) in Romania

Romania's commitment to ORRI is exemplified through national and EU-supported initiatives, with the **Executive Agency for Higher Education, Research, Development, and Innovation Funding (UEFISCDI)** playing a central role in advancing these efforts. Romania has adopted open-access mandates for research funded by both national and European Union programs. These mandates require publicly funded research to be freely accessible through institutional repositories or open-access journals, promoting transparency in the scientific process and the democratization of knowledge.

By ensuring research outputs are openly available, Romania aligns itself with the European Union's broader goals of fostering open science and making research findings accessible to a global audience. Open-access policies not only enhance transparency but also facilitate the reuse of data, driving further innovation and development across multiple sectors.

A key aspect of Romania's approach to open access is its strong emphasis on citizen engagement in research. Supported by UEFISCDI, Romania actively involves the public in decision-making processes related to research priorities. Citizens are encouraged to participate in citizen science projects, where they contribute to data collection, analysis, and even the formulation of research questions. These projects address societal challenges while ensuring that research outcomes align with public needs and interests.

Furthermore, UEFISCDI's focus on public engagement fosters inclusivity by providing opportunities for diverse groups, including marginalized and underrepresented communities, to contribute to and shape scientific endeavors. This inclusive approach reflects ORRI principles of collaboration and societal relevance, ensuring that scientific advancements benefit a wide range of stakeholders and address real-world challenges.

By combining open-access mandates with active citizen engagement, Romania strengthens its commitment to responsible, transparent, and inclusive research. These efforts not only enhance Romania's research ecosystem but also solidify its position within the European and global open science communities.

3.3 Lessons learned from best practices

In comparison, Balkan countries are still at an early developmental stage in embedding ORRI into their research and innovation systems. While initiatives like WBC-RRI.NET have laid a strong foundation, the region lacks comprehensive national frameworks to systematically enforce ORRI principles. Key challenges include limited infrastructure for open access, insufficient funding mechanisms for collaborative projects, and inconsistent policy enforcement across countries.

However, learning from Scandinavian practices offers valuable insights. Similar to Scandinavia's centralized **innovation clusters**, the Balkans could establish regional ORRI hubs. These hubs would serve as coordination points, connecting academia, government bodies, and industry to streamline research efforts and innovation activities. By focusing on addressing specific regional challenges, such as environmental sustainability and digital transformation, these hubs could drive impactful, cross-sectoral solutions.

Additionally, the Balkans could adopt a unified policy framework for ORRI, promoting consistent standards for data sharing, ethical governance, and public engagement across the region. Such a framework would encourage cross-border collaborations and attract international funding, fostering a more integrated and innovative research environment.

Governments in the Balkans can further support ORRI adoption by providing financial incentives, such as grants or tax reductions, to encourage private-sector participation in open science initiatives. Aligning these incentives with **EU programs** like **Horizon Europe** could significantly enhance regional innovation capabilities.

Scandinavia's success underscores the importance of a well-coordinated, multi-stakeholder approach to ORRI. By adapting these strategies to the Balkan context, the region can accelerate its progress in building transparent, inclusive, and socially impactful research systems. Establishing partnerships with Scandinavian countries or organizations would facilitate knowledge transfer and capacity building, helping the Balkans implement best practices and overcome existing challenges.

To further expand ORRI adoption, the Balkans would benefit from targeted capacity-building initiatives. Training programs tailored for researchers, NGOs, and municipal authorities can bridge technical gaps and improve resource utilization. For example, digital tools such as open data repositories and citizen science applications could enable broader participation in research activities.

Finally, establishing annual ORRI forums in the Balkans would create a platform for knowledge-sharing and networking, catalyzing innovation and fostering collaboration across the region. By adopting these measures, the Balkans can chart a path toward a more integrated, transparent, and inclusive research and innovation ecosystem that aligns with EU objectives while addressing the region's societal needs effectively.

3.3.1 Barriers to ORRI adoption in the Balkans

Despite the progress made by Balkan countries in adopting ORRI principles, several challenges continue to hinder the broader implementation of these practices:

- **Limited Infrastructure**: Many local NGOs and municipalities across the Balkans face significant challenges in accessing modern research tools and technologies required for data analysis, dissemination, and collaboration. This lack of infrastructure hampers their ability to engage in data-driven research effectively. NGOs and small municipalities, in particular, often lack the capacity to manage large datasets or utilize advanced digital platforms essential for open science initiatives. As a result, their contributions to policy-making and large-scale research collaborations remain limited.
- **Insufficient Policy Frameworks**: While some Balkan countries have initiated reforms to support ORRI, there remains a lack of comprehensive, region-wide policies. Many countries do not have centralized or national frameworks to govern the open sharing of research data**,** the public's involvement in research, or the ethical oversight of innovations. This absence of cohesive policies hinders the systematic adoption of ORRI principles and limits cross-sector collaboration among academia, government, and civil society. Additionally, the lack of coordination between key stakeholders—such as policymakers, researchers, and private companies—further slows the implementation of ORRI across the region.
- **Budgetary Constraints**: Financial limitations pose a significant barrier for local governments and research institutions in the Balkans. Municipalities, in particular, operate under tight budgets that are often insufficient to fund the data infrastructure and resources necessary to support ORRI initiatives. Moreover, these constraints make it difficult to incentivize public-private partnerships or invest in projects that promote open science and inclusive innovation. Without adequate funding, it becomes challenging for institutions to fully engage in ORRI practices or scale existing efforts.

Addressing these barriers will require strategic investments in infrastructure, the development of robust policy frameworks, and increased financial support to empower local governments, research institutions, and NGOs to advance ORRI principles effectively.

3.3.2 Recommendations for barriers

To address the challenges hindering the adoption of ORRI in the Balkans and to foster a more robust ORRI ecosystem, the following strategies and solutions can be implemented:

- **Leveraging the EU Open Science Cloud (EOSC)**: The **EU Open Science Cloud (EOSC)** serves as a model for how shared infrastructure can overcome resource and capacity limitations. EOSC provides researchers with free access to data, computing resources, and collaborative tools. The Balkans could greatly benefit from a similar initiative by offering local researchers, NGOs, and municipalities access to cloud-based platforms for research and data management. Institutions with limited budgets would no longer need to develop these tools independently, enabling them to actively participate in open science initiatives. Shared infrastructure would also enhance collaboration between Balkan countries and the broader European research community. By adopting an open science cloud model, Balkan countries can ensure that research data and findings are accessible to all relevant stakeholders—researchers, policymakers, and the public—promoting cross-border cooperation and knowledge sharing.
- **Establishing Regional Resource Centers**: To bridge infrastructure gaps, the Balkans could create regional innovation hubs or resource centers. These hubs would act as shared spaces for data storage, research tools, and capacity-building initiatives. By pooling resources and offering centralized ORRI-related services, these centers would reduce the financial and technical burden on individual institutions.
- **Regional hubs** could also facilitate training programs for researchers, policymakers, and NGOs, equipping them with the skills needed to fully engage in open science and responsible innovation. Successful examples of such hubs exist in Central Europe, including Poland and Hungary, where innovation centers have demonstrated the benefits of collaborative spaces for fostering cross-border cooperation and innovation. By replicating these models, the Balkans can accelerate the development of integrated and efficient ORRI ecosystems while strengthening collaboration at the regional level.
- **Implementing Incentive Programs forORRI-Aligned Projects**: To address budgetary constraints and encourage broader adoption of ORRI principles, Balkan countries could introduce incentive programs specifically designed to support ORRI initiatives. For instance, targeted grants could help NGOs, municipalities, and academic institutions fund open science projects or collaborative research efforts.

Additionally, offering tax breaks or subsidies for private-sector businesses that engage in responsible innovation would incentivize private-sector participation in ORRI. These financial incentives would help organizations overcome the initial cost barriers of adopting open science practices.

Programs like Horizon Europe and Erasmus+ demonstrate how well-designed grant mechanisms can drive cross-border research and innovation. The Balkans could develop similar funding schemes tailored to support ORRI projects, ensuring that local researchers, organizations, and institutions have the financial resources they need to implement and scale ORRI practices successfully.

By leveraging shared infrastructure, creating collaborative resource centers, and introducing targeted incentives, the Balkans can overcome existing barriers and build a sustainable, inclusive, and transparent research ecosystem that aligns with European and global ORRI standards.

Chapter 4: Survey about the awareness of ORRI principles and their adoption in R&I activities in North Macedonia and Kosovo

4.1 The structure of survey questionnaire

This study aimed to evaluate the awareness, relevance, and adoption of Open and Responsible Research and Innovation (ORRI) principles among researchers in North Macedonia and Kosovo. The survey sought to uncover key challenges and barriers faced by institutions in implementing ORRI, as well as their support needs to advance these practices. The results will provide a foundation for tailoring initiatives that promote ORRI principles across the Balkan region.

The survey was conducted anonymously via Google Forms between **November 15, 2024, and December 15, 2024**. Researchers and representatives from various organizations were invited to participate through email distribution. The anonymity of responses was prioritized to encourage honest feedback and reduce potential response bias. The survey specifically targeted individuals and institutions actively engaged in research activities, ensuring that the collected data would reflect the perspectives of stakeholders most relevant to ORRI practices. A total of 21 researchers participated in the questionnaire.

Survey Structure

The questionnaire was designed to cover multiple dimensions of ORRI adoption and implementation, with the following sections:

- **Demographics and Background Information**:
  - Type of organization (e.g., university, NGO, private sector).
  - Location (country and city).
  - Respondents’ years of experience in research activities.
- **Awareness and Relevance of ORRI Principles**:
  - Familiarity with ORRI concepts such as Open Science, ethical research, and public engagement.
  - Perceived relevance of ORRI dimensions to the respondents’ research activities.
- **Organizational Practices and Challenges**:
  - Current practices related to Open Access, data sharing, and ethical standards.
  - Key challenges faced in implementing ORRI, including financial, cultural, and structural barriers.
- **Adoption Potential and Support Needs**:

    - Likelihood of adopting ORRI principles in the next two years.
    - Types of support required for successful implementation, such as funding, training, and policy development.
- **Interest in Future ORRI-Related Activities**:
    - Willingness to participate in workshops, collaborative projects, and other initiatives promoting ORRI principles.

Survey Period and Data Collection

The survey was distributed over a month-long period, leveraging email outreach to ensure broad participation across the target countries. Invitations were sent to academic institutions, non-governmental organizations, and other stakeholders involved in research and innovation in North Macedonia and Kosovo. The responses were collected in real-time, and the dataset was finalized for analysis after the survey period closed on **December 15, 2024**.

Analytical Approach

To ensure the reliability and validity of the findings, the data underwent thorough cleaning and analysis, including the following steps:

- **Data Cleaning**:
    - Removed incomplete or duplicate responses to maintain the integrity of the dataset.
    - Standardized answers where necessary to improve consistency (e.g., correcting spelling inconsistencies in open-ended responses).
- **Descriptive Analysis**:
    - Examined demographic trends, such as the types of organizations represented and respondents' experience levels.
    - Summarized key metrics, such as the average familiarity with ORRI principles and the most frequently reported challenges.
- **Statistical Validation**:
    - **Reliability Testing**: Cronbach's alpha was applied to Likert-scale questions to evaluate the consistency and reliability of responses.
    - **Chi-Square Tests**: Tested associations between variables, such as organizational type and awareness of ORRI principles, to identify significant differences across groups.
    - **Correlation Analysis**: Analyzed relationships between familiarity with ORRI principles and the likelihood of adopting them in the future.
- **Visualization**:

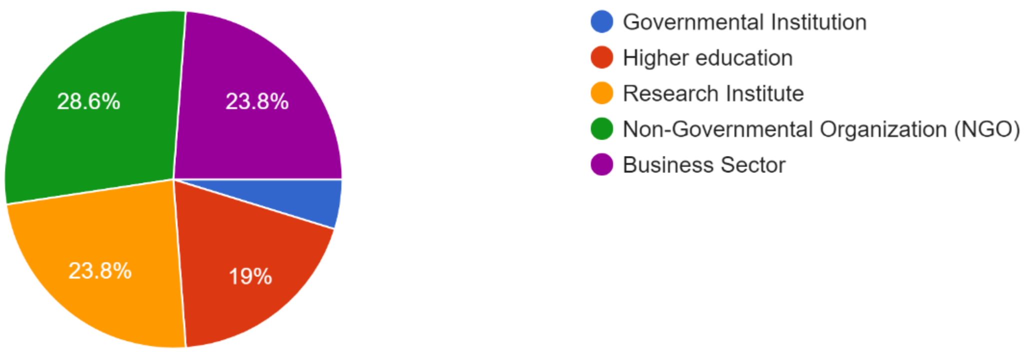
- Created visual aids to simplify the interpretation of findings, including:
  - Pie charts for organizational types and awareness levels.
  - Bar graphs highlighting common challenges and support needs.
  - Heatmaps for cross-country comparisons.

Ethical Considerations

The survey adhered to ethical guidelines for research, ensuring anonymity and confidentiality of responses. Participants were informed about the purpose of the study, and their participation was voluntary. No identifying information was collected, reinforcing the integrity of the data. This comprehensive methodology ensures that the findings accurately capture the current state of ORRI awareness and adoption, while also highlighting actionable areas for intervention and support. Let me know if you'd like further elaboration or specific analysis from the dataset!

4.2 Data analysis with discussion

The survey aimed to assess the awareness, relevance, and adoption of Open and Responsible Research and Innovation (ORRI) principles among researchers in North Macedonia and Kosovo. Conducted over a month (15th November to 15th December 2024), the survey targeted participants engaged in research activities across governmental institutions, higher education, research institutes, NGOs, and the business sector. Data were collected anonymously via Google Forms, and responses provided insights into organizational types, geographical distribution, experience levels, and key challenges.



Graph 1. Type of Organization

The data on organizational types highlights a diverse research landscape, with respondents from **research institutes, NGOs, higher education institutions, business sectors, and governmental institutions** contributing to the survey.

- **Key Observations**:

  - NGOs (28.6%) represent the largest group, reflecting their central role in driving scientific advancements and implementing ORRI practices. This emphasizes their leadership in developing innovative solutions and adopting open research methods.
  - NGOs and Higher Education Institutions (23.8% each) play equally significant roles, demonstrating their commitment to fostering public engagement, education, and ethical research practices.
  - Governmental institutions, though representing a smaller share (19%), are critical stakeholders. Their involvement is essential for creating policies, funding mechanisms, and frameworks to support ORRI adoption.
- **Insights**:
  - The presence of multiple sectors underscores the collaborative nature of ORRI, which thrives on multi-stakeholder participation.
  - However, the business sector's equal representation suggests increasing interest in research and innovation-driven initiatives. Encouraging stronger public-private partnerships can further support ORRI principles, particularly in open innovation.
- **Conclusion**:
  The participation of varied organizations highlights the growing ecosystem for ORRI adoption. Strengthening collaboration across these sectors can address challenges such as financial barriers, awareness, and infrastructure gaps.

Location (Country/City)

The geographical distribution of respondents reveals participation from several key cities across the Balkan region, with Skopje and Prishtina standing out as major contributors.

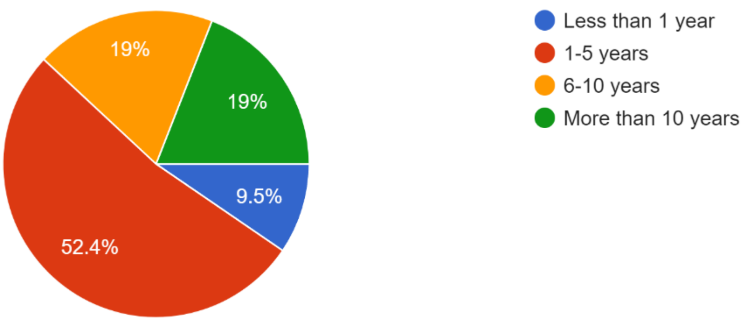
- **Key Observations**:
  - Skopje, the capital of North Macedonia, had the highest representation (14.3%), reflecting the city's strong research culture and engagement in innovation-related activities.
  - Prishtina and other cities such as Tirana, Podgorica, Sarajevo, and North Macedonia's secondary cities also contributed equally (4.8% each), indicating a distributed interest in ORRI principles.
  - The presence of participants from Düsseldorf suggests cross-border interest, likely linked to academic collaborations or regional research partnerships.
- **Insights**:

    - High representation from capitals like Skopje and Prishtina underscores their role as research and innovation hubs. These cities are well-positioned to lead the regional adoption of ORRI principles.
    - Lower participation from smaller cities highlights the need to extend outreach and awareness campaigns to peripheral areas. Building local capacity in ORRI could reduce regional disparities and improve research access.
- **Conclusion**:
  The data suggests a need to foster regional cooperation across urban centers to scale ORRI implementation. Strategies should focus on connecting smaller cities to leading research hubs, enabling knowledge-sharing and capacity building.

Engagement in Research Activities

A unanimous response rate of **100% engagement** in research activities reflects the relevance of the survey participants to the study's objectives.

- **Key Observations**:
    - Every respondent actively participates in research activities, ensuring that the findings are grounded in real-world experiences and challenges.
    - This strong engagement provides a reliable baseline for assessing the awareness and adoption of ORRI principles.
- **Insights**:
    - The full participation highlights a motivated research community that is actively contributing to scientific progress. This creates a strong foundation for advancing ORRI practices such as open access, ethical research, and public engagement.
    - The lack of "non-engaged" respondents suggests that the survey successfully targeted a relevant audience, ensuring meaningful and actionable insights.
- **Conclusion**:
  Researchers in North Macedonia and Kosovo demonstrate strong engagement in scientific activities, which is promising for the future adoption of ORRI principles. Efforts should focus on building their capacity to overcome barriers such as lack of funding, training, and institutional support.

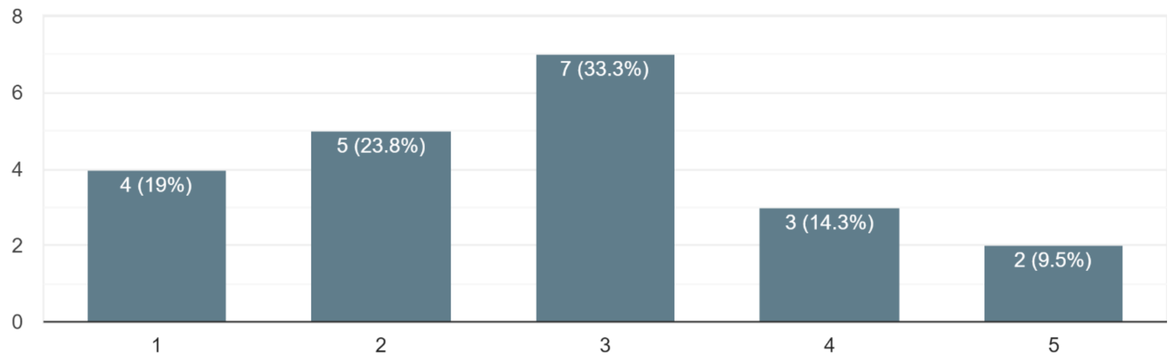


Graph 2. Years of Experience in Research Activities

The respondents' experience levels reveal a mix of early-career and senior researchers, providing a balanced perspective.

- **Key Observations**:
  - Over half (52.4%) of respondents have **1-5 years of experience**, suggesting a large proportion of early-career researchers. This group represents the future of research and innovation in the region.
  - Researchers with **6-10 years** (19%) and **more than 10 years** (19%) provide valuable insights from mid-career and experienced professionals, who often influence organizational policies and practices.
  - A small but notable proportion (9.5%) of respondents are newcomers with **less than 1 year** of experience, highlighting the importance of integrating ORRI principles into early career development programs.
- **Insights**:
  - Early-career researchers are more adaptable to new concepts such as open science and public engagement.
  - Senior researchers bring essential experience and credibility to support the implementation of ORRI practices within organizations. However, their role should also include mentoring younger researchers on ethical and transparent research methods.
  - Addressing the needs of young researchers, such as providing training for newcomers and policy support, will ensure holistic adoption of ORRI.
- **Conclusion**:

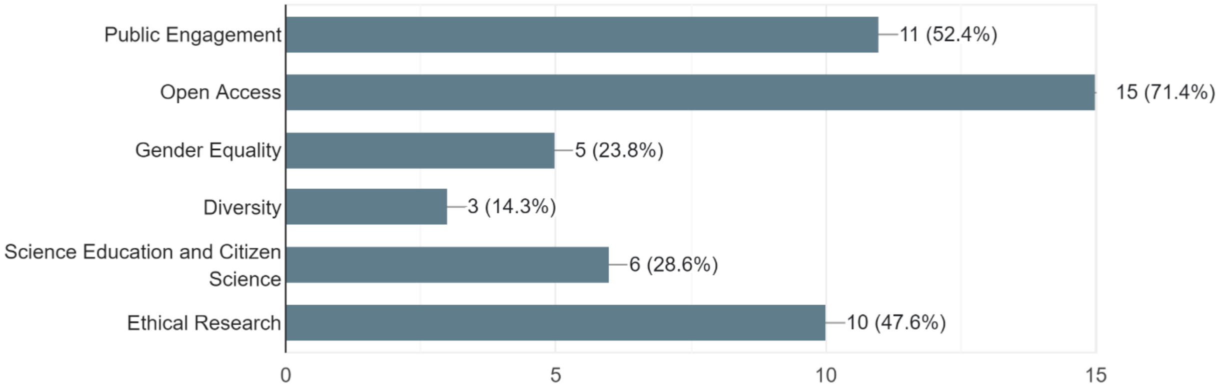
  The diverse experience levels among respondents highlight the need for tailored strategies to promote ORRI principles. For early-career researchers, initiatives such as training and mentorship programs are critical. For experienced professionals, focus on leadership and advocacy can help institutionalize ORRI practices.



Graph 3. How familiar are you with ORRI/RRI (Open and Responsible Research and Innovation) principles?

- **Key Observations**:
    - A significant portion of respondents rate their familiarity as **moderate** (3 on the scale), with **33.3%** falling in this category.
    - A combined **42.8%** of respondents express low familiarity (ratings 1 and 2), indicating limited awareness among nearly half of the participants.
    - Higher familiarity levels (4 and 5) are less frequent, with only **23.8%** of participants rating themselves as highly familiar.
- **Insights**:
    - The majority of respondents are either moderately aware or lack familiarity with ORRI principles. This suggests a gap in understanding the concepts of open science, public engagement, and responsible innovation.
    - The low levels of high familiarity (4 and 5) highlight the need for targeted awareness campaigns, training programs, and knowledge-sharing initiatives.
    - Improving familiarity with ORRI principles is critical for enabling researchers to integrate these practices into their daily research activities effectively.
- **Conclusion**:

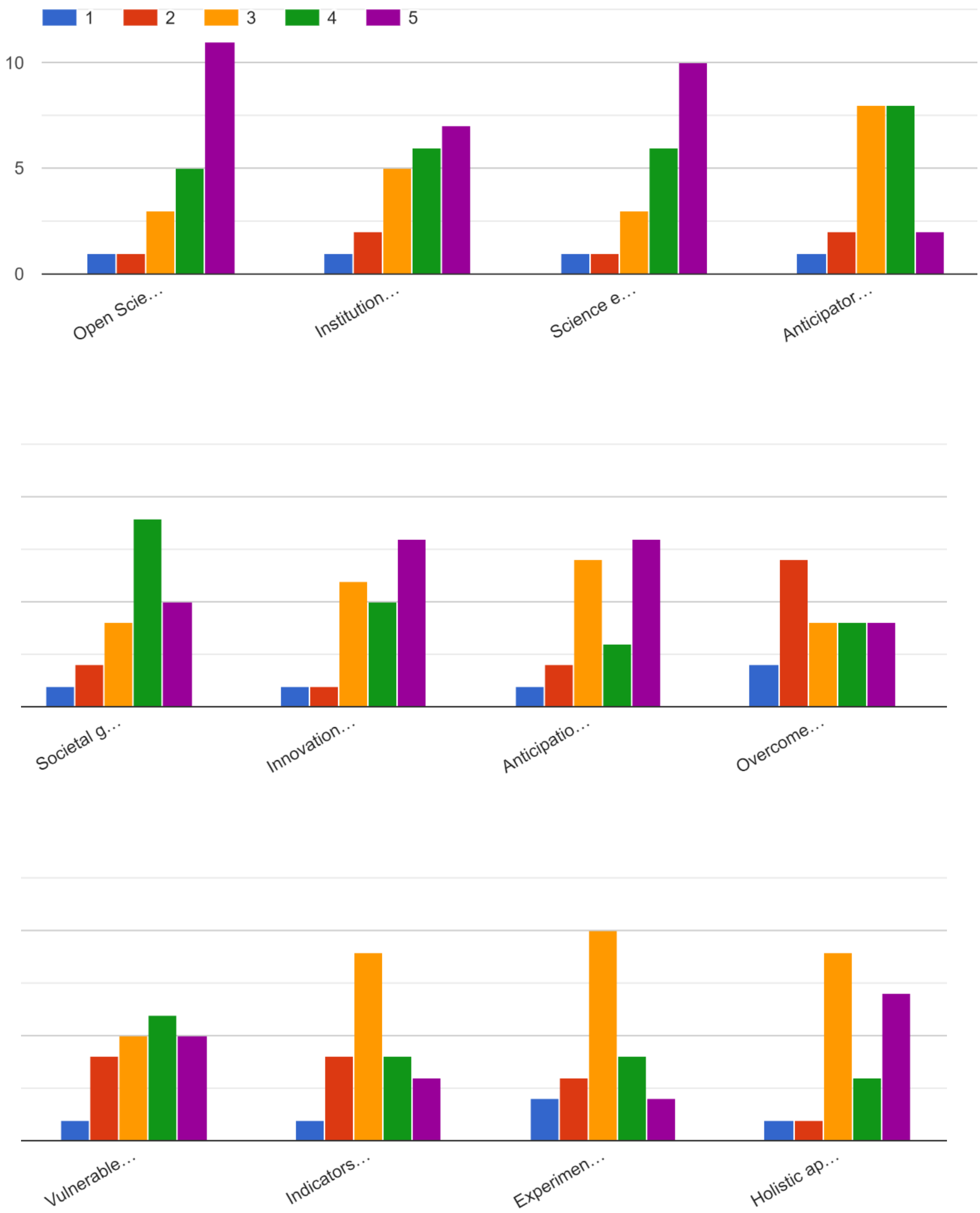
  There is a clear need for capacity-building initiatives to enhance awareness of ORRI principles. Workshops, educational resources, and institutional support can help bridge this knowledge gap, particularly among those with lower familiarity.



Graph 4. Which two ORRI/RRI dimensions do you consider most relevant to your research?

- **Key Observations**:
  - The top two dimensions considered most relevant are:
    - **Open Access**: 15 responses (**71.4%**).
    - **Public Engagement**: 11 responses (**52.4%**).
  - Other key dimensions include:
    - **Ethical Research**: 10 responses (**47.6%**).
    - **Science Education and Citizen Science**: 6 responses (**28.6%**).
    - **Gender Equality**: 5 responses (**23.8%**).
    - **Diversity**: 3 responses (**14.3%**).
- **Insights**:
  - **Open Access** is the most prioritized dimension, reflecting its importance in democratizing knowledge and increasing the visibility of research outputs. This aligns with global trends emphasizing open publication and data sharing.
  - **Public Engagement** ranks second, highlighting the recognition of involving society in the research process. This indicates a growing awareness of the need to connect research outcomes with societal needs and values.
  - While Ethical Research is also considered important (47.6%), dimensions like **Diversity** and **Gender Equality** received lower recognition, suggesting potential areas for improvement.
  - The lower emphasis on Diversity (14.3%) signals a gap in understanding its role in fostering inclusive and equitable research environments.
- **Conclusion**:

  The data indicates that Open Access and Public Engagement are perceived as the most relevant ORRI dimensions, underscoring their immediate value to the research community. However, initiatives are needed to raise awareness and emphasize the importance of dimensions like Diversity and Gender Equality. By promoting a more holistic adoption of ORRI principles, researchers can address societal challenges more effectively.



Graph 5. Relevance of ORRI/RRI Principles to Research

Key Observations

Graph 5 represents how respondents rated the relevance of various ORRI/RRI principles to their research, on a scale of 1 to 5 (1 = not relevant, 5 = most relevant). Each principle received a range of ratings, indicating varying degrees of importance across the research community.

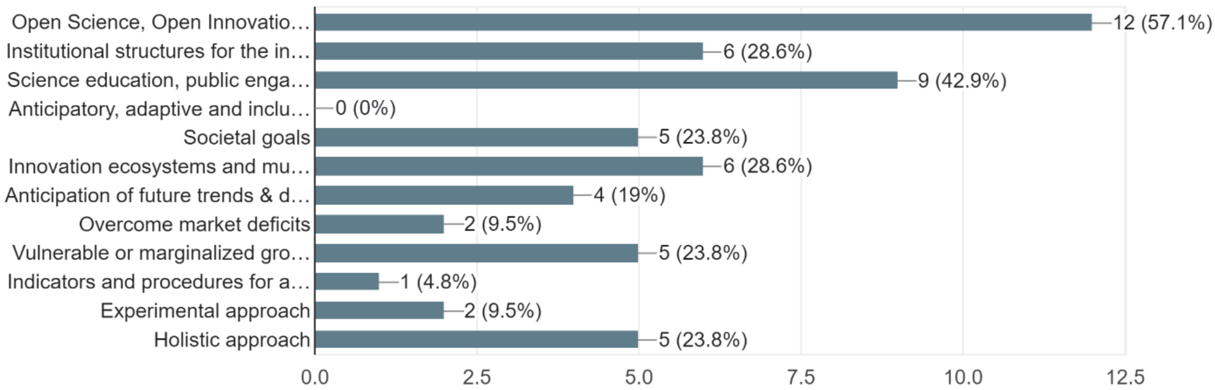
- **Highly Relevant Principles**:
    - **Open Science, Open Innovation, and Transparency**: A significant number of respondents rated this principle as **highly relevant (5)**, suggesting that open access to research and innovation plays a central role in their work.
    - **Societal Goals**: This principle also stands out, with many ratings of **4 and 5**, emphasizing its importance in aligning research outcomes with societal needs.
    - **Anticipation and Adaptation**: Strong ratings in this area reflect the value researchers place on forward-looking, strategic approaches to R&I.
- **Moderately Relevant Principles**:
    - Principles related to **Innovation Ecosystems and Multi-Stakeholder Commitment** and **Institutional Structures for Integrity** received moderate ratings, with a mix of scores across the 3 to 5 range.
    - **Experimental and Holistic Approaches** received notable mentions, particularly in the **4 range**, suggesting their growing relevance in interdisciplinary and practical research.
- **Less Relevant Principles**:
    - Dimensions such as **Overcoming Market Deficits** and **Vulnerable or Marginalized Groups** saw relatively fewer ratings in the **4 and 5 categories**, suggesting these are less prioritized in current research activities.

Insights

- The strong emphasis on **Open Science and Societal Goals** indicates a clear preference for principles that promote research accessibility and direct societal impact. This aligns with global trends emphasizing open access and socially responsible innovation.
- The moderate relevance of principles like **Experimental and Holistic Approaches** highlights their growing adoption but suggests room for further integration into research practices.
- Lower relevance ratings for principles like **Overcoming Market Deficits** indicate that these areas may require targeted awareness or strategic interventions to highlight their value within the broader ORRI framework.

Conclusion

The findings reveal a strong alignment of research priorities with principles that emphasize openness, societal benefit, and forward-thinking approaches. However, areas such as market deficits and support for marginalized groups require greater emphasis to achieve a more holistic adoption of ORRI principles. Tailored initiatives, training, and capacity-building efforts can help raise awareness and drive integration across all dimensions.



Graph 6. Which Three ORRI Principles Do You Use the Most in Practice?

Key Observations

The chart illustrates the ORRI principles most frequently used in practice by respondents. Participants could select up to three principles, and the results highlight clear preferences and trends:

- **Most Frequently Used Principles**:
  - **Open Science, Open Innovation, and Transparency** stands out as the top choice, selected by **57.1% (12 respondents)**. This reflects its central role in current research practices, particularly in promoting accessible and transparent scientific outputs.
  - **Science Education, Public Engagement, and Active Citizenship** is the second most utilized principle, chosen by **42.9% (9 respondents)**. This emphasizes a strong focus on engaging society in research processes and fostering a culture of science literacy.
- **Moderately Used Principles**:
  - **Institutional Structures for Integrity** and **Innovation Ecosystems and Multi-Stakeholder Commitment** each received **28.6% (6 respondents)**, indicating their importance in ensuring ethical practices and collaboration across sectors.

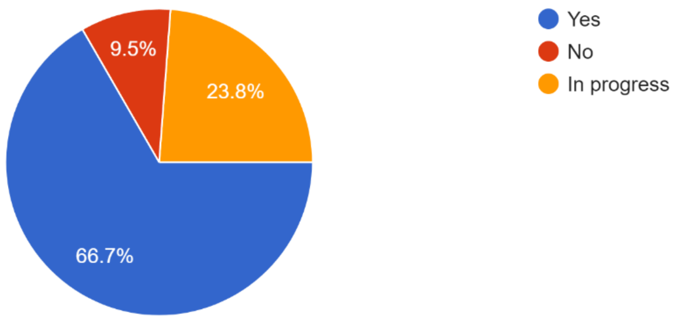
  - **Societal Goals** and the **Holistic Approach** were each selected by **23.8% (5 respondents)**, reflecting a moderate level of implementation among the research community.
- **Least Used Principles**:
  - **Anticipatory, Adaptive, and Inclusive Governance** (0%) did not receive any selections, signaling its perceived lack of relevance or implementation in current practices.
  - Principles like **Overcome Market Deficits**, **Experimental Approach**, and **Indicators for Agency and Accountability** were among the least chosen, with selection rates ranging between **4.8% to 9.5%**.

Insights

- The dominance of **Open Science, Open Innovation, and Transparency** aligns with the global trend of promoting open access and data-sharing practices. Researchers recognize its immediate benefits, such as increased visibility and collaborative opportunities.
- The strong focus on **Science Education and Public Engagement** highlights an awareness of the need to connect research with societal needs, encouraging active participation from the public in shaping scientific priorities.
- The limited use of principles like **Anticipatory Governance** and **Overcoming Market Deficits** indicates a gap in forward-looking strategies and addressing market challenges. This may stem from a lack of understanding, support, or resources to implement these dimensions effectively.

Conclusion

The data underscores the emphasis on principles that prioritize openness, public engagement, and collaboration. However, principles with forward-looking, adaptive, or market-oriented aspects remain underutilized. Moving forward, targeted initiatives and support frameworks can help researchers integrate these less-used principles into practice, fostering a more comprehensive adoption of ORRI practices.



Graph 7. Does Your Organization Provide Open Access to Research Outputs?

Key Observations

The pie chart illustrates the extent to which organizations provide open access to research outputs:

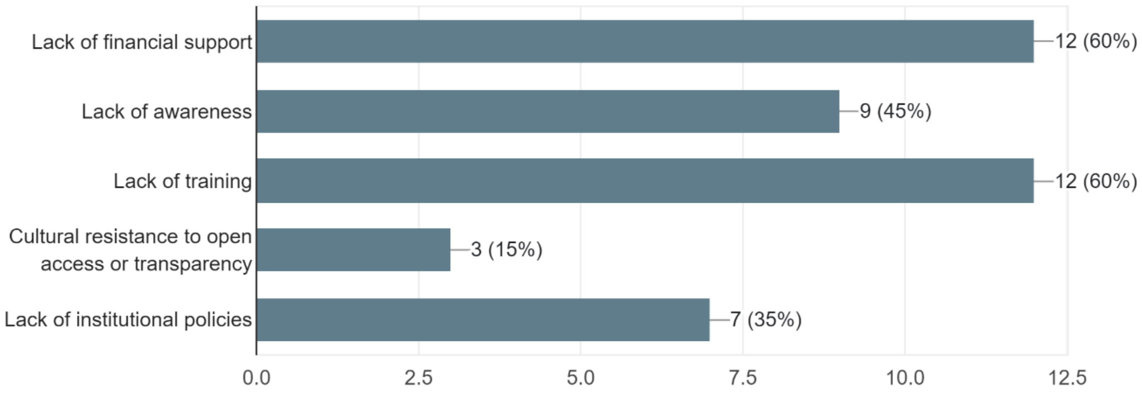
- **Yes**: 66.7% of respondents reported that their organizations currently provide open access.
- **In Progress**: 23.8% indicated that efforts to enable open access are ongoing.
- **No**: 9.5% reported that open access is not currently practiced in their organizations.

Insights

- The majority (66.7%) providing open access demonstrates a growing adoption of open science practices, aligning with ORRI principles. This is a promising trend that contributes to knowledge democratization and research visibility.
- The **23.8% "In Progress"** response highlights ongoing efforts but also signals a need for institutional support, such as infrastructure and training, to transition fully toward open access.
- The **9.5% of organizations not providing open access** may face challenges such as financial constraints, lack of awareness, or institutional resistance. These barriers need to be addressed to ensure equitable participation in open science practices.

Conclusion

While progress is evident, efforts must focus on enabling the remaining organizations to adopt open-access practices. Support mechanisms, such as funding, policy development, and awareness campaigns, are essential for ensuring that open access becomes a standard practice across the region.



Graph 8. Barriers and Support Needs: Challenges in Adopting ORRI Principles

Key Observations

The horizontal bar chart identifies the main challenges faced by respondents in adopting ORRI principles:

- **Lack of Financial Support**: Selected by **60% (12 respondents)**, this is the most significant challenge, emphasizing the need for dedicated funding.
- **Lack of Training**: Tied with financial barriers, **60% (12 respondents)** reported insufficient training opportunities as a major obstacle.
- **Lack of Awareness**: **45% (9 respondents)** identified limited understanding of ORRI principles as a barrier.
- **Lack of Institutional Policies**: Reported by **35% (7 respondents)**, this highlights gaps in organizational support structures.
- **Cultural Resistance to Open Access or Transparency**: Mentioned by **15% (3 respondents)**, this indicates sociocultural barriers in embracing open and transparent research practices.

Insights

- **Financial Support and Training** are critical challenges, as reported by the majority of respondents. Addressing these issues through targeted funding schemes and training programs will directly enhance ORRI adoption.
- **Awareness Gaps** suggest a need for educational initiatives to improve understanding of ORRI principles, particularly among organizations at earlier stages of adoption.

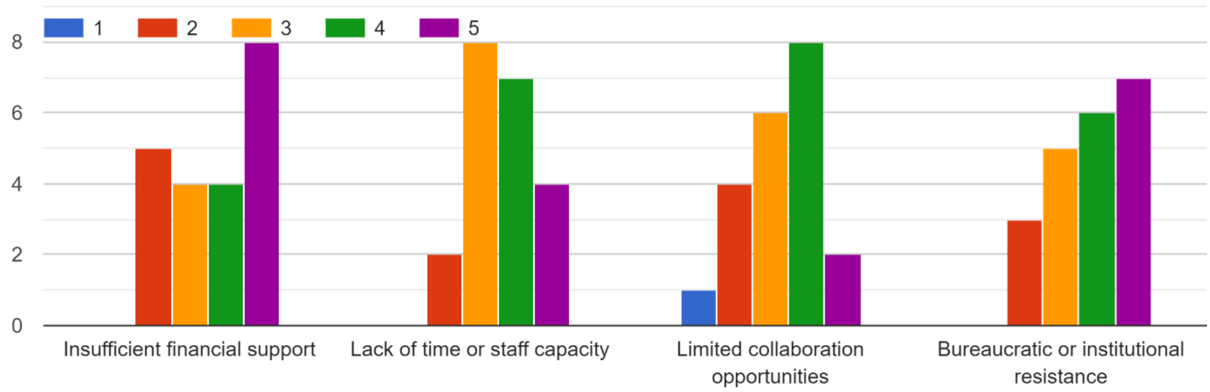
- **Institutional Barriers** indicate the need for clearer policies and frameworks to promote and sustain ORRI practices. Organizational leadership must prioritize the development of internal guidelines for open science and responsible innovation.
- **Cultural Resistance**, though less frequent, points to potential reluctance or misconceptions about the value of transparency and open access. Awareness campaigns highlighting the benefits of ORRI can help overcome such resistance.

Conclusion

To overcome these challenges, a multi-faceted approach is necessary:

- **Funding**: Increase access to financial support through grants and incentives.
- **Training**: Offer workshops and capacity-building programs to equip researchers with ORRI-related skills.
- **Policy Development**: Encourage organizations to implement clear, supportive policies for ORRI adoption.
- **Awareness Campaigns**: Highlight the benefits of ORRI principles to shift cultural attitudes and build understanding.

By addressing these barriers, organizations can foster a more open, inclusive, and responsible research environment that aligns with ORRI principles.



Graph 9. Barriers to Implementing ORRI/RRI in Your Organization

Key Observations

The bar chart shows how respondents rated various barriers to implementing ORRI/RRI principles on a scale of 1 (not significant) to 5 (very significant):

- **Insufficient Financial Support**:
  - Rated as a **5** (most significant barrier) by the majority. This highlights financial constraints as the top issue in ORRI implementation.

  - Other ratings (3 and 4) also show this is a persistent challenge across organizations.
- **Lack of Time or Staff Capacity**:
  - A considerable number of respondents rated this barrier as **5 (very significant)**, with additional support for levels **4 and 3**.
  - The results suggest resource limitations, including staffing and workload pressures, are common organizational issues hindering ORRI adoption.
- **Limited Collaboration Opportunities**:
  - This barrier received mixed ratings, with **5 and 4** being the most frequent. However, a noticeable number of participants rated it lower (2 and 3), indicating variation in how this issue affects organizations.
- **Bureaucratic or Institutional Resistance**:
  - Institutional resistance was identified as a notable barrier, with many respondents rating it **4 and 5**.
  - This suggests organizational culture, rigid policies, and bureaucratic inertia impede progress toward implementing ORRI principles.

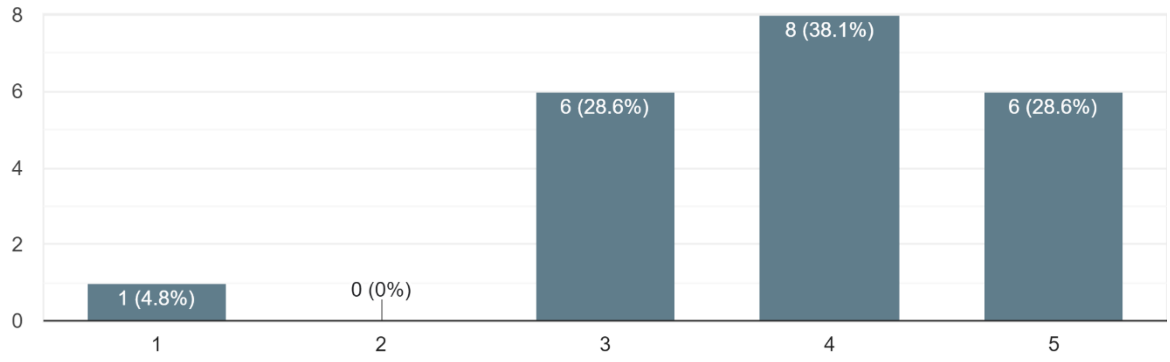
Insights

- **Financial constraints and resource limitations** are the most significant barriers, highlighting the need for financial support, grants, and additional staff capacity.
- **Institutional resistance** points to structural and cultural challenges, emphasizing the need for leadership buy-in and organizational change.
- **Collaboration opportunities**, while a barrier for some, vary widely across organizations, suggesting that networks or partnerships may already exist in certain sectors but require scaling.

Conclusion

Addressing these barriers requires a multifaceted strategy:

- **Increased funding**: Financial grants, incentives, and resource allocation for ORRI adoption.
- **Capacity building**: Staffing solutions, workload management, and skill development.
- **Policy reforms**: Streamlining institutional structures to reduce bureaucratic resistance.
- **Collaboration platforms**: Facilitating networks to overcome isolation and foster partnerships.



Graph 10. Opportunities & Future Plans: Likelihood to Adopt ORRI Principles in the Next Two Years

Key Observations

The bar chart highlights respondents' likelihood of adopting ORRI principles in the near future:

- **38.1% of respondents rated their likelihood as 4**, suggesting a strong intention to integrate ORRI principles.
- **28.6%** rated their likelihood as **5 (very likely)**, indicating high commitment and readiness among a significant portion of participants.
- **28.6% selected 3**, representing moderate interest or uncertainty in adoption.
- A small proportion **(4.8%) rated their likelihood as 1**, indicating minimal interest or significant challenges.

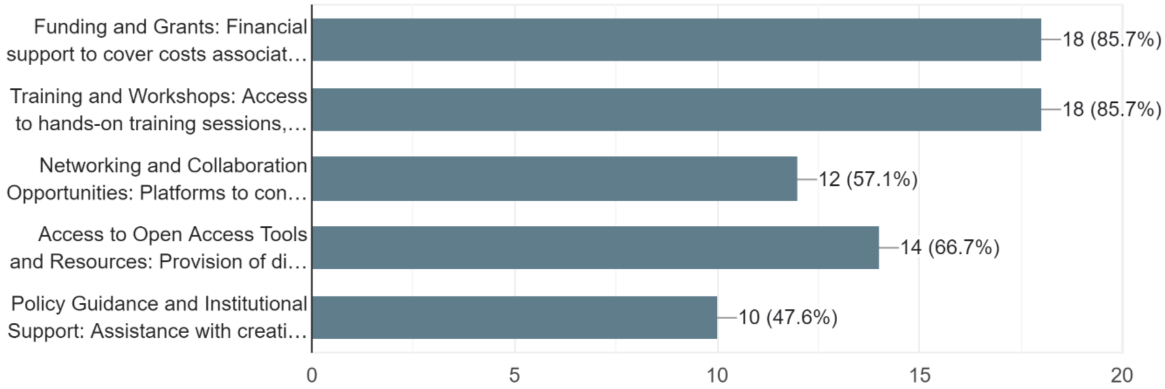
Insights

- The majority of respondents are optimistic about adopting ORRI principles, with over two-thirds selecting **4 or 5**. This reflects a positive outlook and suggests that many organizations are ready to align their practices with ORRI frameworks.
- The group selecting **3** may require additional support, such as training, awareness campaigns, or funding, to move toward higher adoption levels.
- The small percentage of respondents at **1** highlights persistent barriers that may require targeted intervention, such as addressing financial constraints or cultural resistance.

Conclusion

The results demonstrate strong potential for future adoption of ORRI principles, particularly if key barriers (financial support, staffing, and institutional policies) are addressed. Moving forward:

- **Supportive frameworks**: Provide financial incentives, capacity-building programs, and collaboration opportunities.
- **Targeted outreach**: Focus on organizations with moderate or low likelihood to ensure they have the tools and knowledge to adopt ORRI practices.
- **Highlight benefits**: Showcase the advantages of ORRI principles to encourage widespread adoption and commitment.



Graph 11. What Support Would Help You in Implementing ORRI Principles?

Key Observations

Respondents identified the types of support that would enable them to implement ORRI principles effectively:

- **Funding and Grants**: Selected by **85.7% (18 respondents)** as the most critical form of support, emphasizing the role of financial resources in overcoming adoption barriers.
- **Training and Workshops**: Also chosen by **85.7%**, highlighting the need for hands-on learning and capacity-building opportunities.
- **Access to Open Access Tools and Resources**: Chosen by **66.7% (14 respondents)**, indicating the importance of having the infrastructure to support open science and responsible research.
- **Networking and Collaboration Opportunities**: Selected by **57.1% (12 respondents)**, showing the need for platforms that facilitate partnerships and shared learning.
- **Policy Guidance and Institutional Support**: Identified by **47.6% (10 respondents)**, reflecting the necessity for clear frameworks and internal policies to drive ORRI adoption.

Insights

- The emphasis on **funding and training** as top priorities underscores the financial and knowledge gaps currently hindering ORRI implementation. Without adequate resources, even motivated researchers struggle to implement ORRI practices effectively.
- The significant demand for **open-access tools and resources** highlights the need for technical infrastructure, such as digital repositories, data-sharing platforms, and collaborative tools.
- **Networking opportunities** are essential for fostering collaboration across institutions and countries, particularly in the Balkan region where shared challenges can be addressed collectively.
- While **policy guidance** ranked lower, its importance cannot be underestimated; institutional frameworks provide the necessary structure and legitimacy for ORRI practices.

Conclusion

The findings reveal a clear roadmap for supporting ORRI adoption:

1. **Financial Support**: Increase access to grants and funding mechanisms to alleviate cost-related barriers.
2. **Training Programs**: Offer workshops and skill development sessions to build researcher capacity.
3. **Infrastructure**: Provide tools and resources for open-access practices.
4. **Collaboration Platforms**: Facilitate networks to encourage partnerships and shared learning.
5. **Policy Development**: Support organizations in creating clear, actionable policies to institutionalize ORRI principles.

By addressing these support needs, stakeholders can empower researchers and institutions to adopt and sustain ORRI practices, fostering a more open, inclusive, and responsible research ecosystem.

Chapter 5: Practical ORRI guidelines and framework for its implementation

5.1 7S Methodology for ORRI Success

This enhanced methodology focuses on actionable steps for young researchers in the Balkan region, addressing the specific barriers identified in the survey: lack of financial support, training opportunities, institutional resistance, and collaboration limitations. By following this guide, researchers can progressively adopt ORRI (Open and Responsible Research and Innovation) principles while overcoming the challenges they face.

Step 1: Assess Your Readiness and Identify Barriers

- **Objective**: Understand your current position and identify specific challenges in adopting ORRI principles.
- **Actions**:
  - **Personal Readiness Assessment**:
    - Evaluate your familiarity with ORRI principles using online quizzes or checklists from platforms like OpenAIRE.
    - Reflect on how often you integrate practices like open access, ethical standards, or societal engagement in your research.
    - Identify gaps in your resources or knowledge (e.g., lack of funding, absence of institutional support, or limited public outreach).
  - **Map Challenges**:
    - Break down barriers into actionable categories:
      - **Funding:** List specific expenses (e.g., Article Processing Charges, workshop costs).
      - **Training:** Identify which skills or tools you lack (e.g., data management, public communication).
      - **Policies:** Assess whether your institution supports open access or ethical research frameworks.
  - **Set Clear Goals**:
  - Define SMART (Specific, Measurable, Achievable, Relevant, Time-bound) goals, such as:
      - Publishing two open-access articles within 12 months.
      - Hosting one public workshop on your research topic.
      - Participating in a citizen science project within six months.

- **Output**: A **Personal ORRI Action Plan** that highlights your strengths, weaknesses, and clear next steps.

Step 2: Overcome Financial Barriers with Strategic Funding

- **Objective**: Secure funding opportunities to support ORRI activities like open-access publishing, workshops, and outreach.
- **Actions**:
  - **Explore Funding Programs**:
    - Research and apply for grants tailored to early-career researchers, such as:
      - Horizon Europe grants for open science.
      - Erasmus+ funding for collaboration projects.
    - Identify open-access journals offering fee waivers or discounts for researchers from low-income regions.
  - **Collaborate for Resource Sharing**:
    - Partner with colleagues to co-author research papers, reducing individual costs.
    - Use shared platforms for open-access publishing, such as institutional repositories or Zenodo.
  - **Seek Local Support**:
    - Approach local NGOs or civic organizations (e.g., COHU or Open Data Kosovo) for small-scale funding or sponsorships.
- **Output**: A **Funding Pipeline** that includes grants applied for, collaborations initiated, and cost-sharing opportunities explored.

Step 3: Build Knowledge Through Targeted Training Programs

- **Objective**: Address gaps in skills and knowledge through accessible training and professional development.
- **Actions**:
  - **Attend Training Programs**:
    - Enroll in free or low-cost courses on ORRI principles via platforms like FOSTER Open Science or Coursera.
    - Look for workshops organized by Balkan research networks or EU-funded projects.

    - **Practice with Tools**:
        - Learn to use Zenodo for data sharing, OSF for project management, and Figshare for visuals.
        - Practice applying FAIR principles to your datasets.
    - **Join Peer Learning Groups**:
        - Create a local network of researchers to share best practices and challenges in ORRI adoption.
- **Output**: A portfolio of completed training sessions and applied tools, validated through certificates or case studies.

Step 4: Start Small with Open Access and Open Data

- **Objective**: Take practical steps toward sharing research outputs openly, addressing both funding and technical limitations.
- **Actions**:
    - **Leverage Existing Platforms**:
        - Publish your work on Zenodo, DASS-BiH, or university repositories with built-in open-access features.
        - Use preprint servers like arXiv to make research available immediately.
    - **Adopt Open Data Practices**:
        - Annotate your datasets clearly to make them reusable by other researchers.
        - Use GitHub or other open-source repositories to share supplementary materials like code or visuals.
- **Output**: Research outputs that are freely accessible, increasing both visibility and citation potential.

Step 5: Strengthen Public Engagement and Collaboration

- **Objective**: Overcome isolation and enhance collaboration by engaging with society and regional stakeholders.
- **Actions**:
    - **Public Outreach**:
        - Host public workshops or webinars to discuss your research findings in accessible language.

        - Develop infographics or blog posts to share insights with non-expert audiences.
    - **Collaborate Locally and Regionally**:
        - Join regional initiatives like the Balkan Scientific Network to connect with peers.
        - Partner with NGOs or local communities for research projects that align with societal challenges.
    - **Citizen Science**:
        - Design projects where citizens can contribute, such as data collection or survey analysis.
- **Output**: Active engagement with stakeholders and stronger community support for research initiatives.

Step 6: Advocate for Institutional Change

- **Objective**: Address bureaucratic or institutional resistance by advocating for ORRI-supportive policies.
- **Actions**:
    - **Engage Leadership**:
        - Present success stories or case studies from your ORRI-related work to inspire institutional buy-in.
        - Advocate for institutional rewards (e.g., career promotions) tied to ORRI practices.
    - **Participate in Policy Dialogues**:
        - Attend university meetings or regional policy forums to propose ORRI-aligned frameworks.
- **Output**: Institutional policies or frameworks that reflect ORRI values, enabling long-term sustainability.

Step 7: Monitor Your Progress and Share Your Success

- **Objective**: Evaluate your efforts in adopting ORRI principles and inspire others.
- **Actions**:
    - **Track and Reflect**:
        - Maintain a journal or online tracker of milestones, challenges, and lessons learned.
        - Use tools like Trello or Notion to organize your progress.

- **Share Results**:
    - Publish your experiences in blogs, articles, or conference presentations.
    - Collaborate with younger peers or students by mentoring them on ORRI adoption.
- **Output**: A comprehensive record of achievements that showcases leadership and inspires broader adoption.

5.2 7S Methodology for policy improvement

To support the adoption and institutionalization of Open and Responsible Research and Innovation (ORRI) principles, the following key policy recommendations are proposed. These are designed to address the challenges faced by young researchers in the Balkan region, including financial barriers, institutional resistance, limited awareness, and capacity gaps.

1. Establish Dedicated Funding Mechanisms for ORRI Implementation

- **Issue Addressed**: Lack of financial support was identified as a primary barrier to adopting ORRI practices.
- **Recommendations**:
    - Develop **national and regional funding schemes** specifically aimed at supporting ORRI activities, such as:
        - Grants for open-access publishing (to cover Article Processing Charges - APCs).
        - Funding for public engagement initiatives (e.g., citizen science, workshops).
        - Financial incentives for ethical research projects or gender-inclusive studies.
    - Encourage participation in **EU programs** like Horizon Europe or Erasmus+ to access co-financing opportunities.
    - Provide **micro-grants** for early-career researchers to support small-scale ORRI projects, such as data-sharing platforms or open repositories.

Outcome: Reduced financial burden for individual researchers, enabling broader implementation of ORRI principles.

2. Develop Institutional Policies to Promote Open Access and Transparency

- **Issue Addressed**: Limited institutional support and resistance to change were key challenges for researchers.
- **Recommendations**:
  - Require universities and research institutions to adopt **mandatory open-access policies** for publicly funded research.
  - Support the development of **digital repositories** at institutional and regional levels to enable free access to research outputs and datasets.
  - Introduce **institutional rewards** (e.g., career incentives, promotions) for researchers who actively practice ORRI, such as publishing open-access papers or engaging the public in research.
  - Establish guidelines to align research outputs with the **FAIR principles** (Findable, Accessible, Interoperable, Reusable).

Outcome: Strengthened institutional frameworks that support transparency, accessibility, and ethical research practices.

3. Prioritize Capacity Building Through Training and Education

- **Issue Addressed**: Gaps in training and awareness hinder researchers from adopting ORRI principles effectively.
- **Recommendations**:
  - Design and implement **national training programs** on ORRI principles, with a focus on:
    - Open Science practices (e.g., using platforms like Zenodo, OpenAIRE).
    - Ethical research and gender equality frameworks.
    - Public engagement tools and methods.
  - Integrate ORRI modules into **university curricula** and graduate-level programs to build awareness early in researchers' careers.
  - Provide **online courses, webinars, and workshops** tailored for young researchers, with support from local NGOs, academic networks, and EU programs.
  - Create mentorship programs where senior researchers guide early-career professionals in implementing ORRI practices.

Outcome: Improved skills and knowledge, enabling young researchers to adopt ORRI effectively in their work.

4. Foster Collaboration and Knowledge Sharing

- **Issue Addressed**: Limited opportunities for collaboration and isolation hinder regional progress on ORRI.
- **Recommendations**:
  - Establish **regional ORRI networks** to facilitate collaboration between researchers, institutions, and NGOs across the Balkan region.
  - Develop **cross-border platforms** for knowledge-sharing, resource pooling, and joint projects (e.g., Balkan Open Science Network).
  - Support partnerships between researchers and local communities to encourage **citizen science initiatives**.
  - Promote **interdisciplinary collaborations** to ensure diverse perspectives are included in research design and implementation.

Outcome: Enhanced collaboration, reducing barriers to resources, expertise, and knowledge exchange.

5. Create Incentives for Ethical and Inclusive Research

- **Issue Addressed**: Ethical research and inclusivity, including gender equality and diversity, are underemphasized in current practices.
- **Recommendations**:
  - Introduce **ethical research certification programs** that recognize projects adhering to ORRI principles.
  - Support policies that promote **gender-balanced teams** and inclusivity in research practices, especially in leadership roles.
  - Provide funding incentives for research that addresses societal challenges, particularly those affecting marginalized or underrepresented groups.
  - Establish institutional ethical review committees to guide researchers in integrating responsible research practices.

Outcome: Strengthened focus on ethical research, inclusivity, and alignment with societal needs.

6. Support Public Engagement and Societal Impact

- **Issue Addressed**: Public engagement remains underdeveloped, with limited outreach tools and platforms.
- **Recommendations**:

- Develop policies that encourage researchers to include **public engagement activities** in their projects, such as citizen science, public workshops, and open forums.
- Support the creation of **communication toolkits** for researchers to share findings with non-expert audiences.
- Require publicly funded research projects to demonstrate societal impact and outline strategies for engaging relevant stakeholders.
- Partner with schools and NGOs to foster **science education initiatives**, bridging the gap between researchers and society.

Outcome: Improved societal trust, broader awareness of scientific advancements, and increased public participation in research processes.

7. Monitor Progress and Create Accountability Mechanisms

- **Issue Addressed**: Lack of institutional policies and accountability slows the adoption of ORRI principles.
- **Recommendations**:
  - Implement **monitoring systems** to assess progress in ORRI adoption at institutional and national levels.
  - Develop **indicators and benchmarks** to evaluate open-access outputs, ethical compliance, gender equality, and public engagement efforts.
  - Publish **annual ORRI progress reports** to hold institutions accountable and showcase success stories.
  - Encourage external audits and evaluations to ensure transparency and consistency in ORRI implementation.

Outcome: Clear accountability mechanisms driving institutional and regional progress toward ORRI integration.

5.3 Empowering Young Researchers for ORRI Success

The journey toward integrating Open and Responsible Research and Innovation (ORRI) principles is both challenging and transformative. For young researchers in the Balkan region, this guide serves as a roadmap to overcome barriers, embrace opportunities, and lead meaningful change in research and innovation practices.

As the scientific community continues to evolve, the role of young researchers becomes even more critical in fostering openness, transparency, inclusivity, and societal impact. The steps outlined in the **7S Methodology for ORRI Success** and the **policy recommendations** empower individuals not only to adapt but also to thrive in this environment of responsible research.

Key Takeaways for Young Researchers

1. **Start Small, Think Big**: Begin with achievable goals, such as publishing one open-access paper or engaging a community in your research, but always keep the broader vision of societal impact in mind.
2. **Collaborate and Network**: Build relationships with peers, institutions, and communities to share knowledge, resources, and support. Networks like the Balkan Scientific Network or platforms like OpenAIRE can be instrumental.
3. **Advocate for Change**: Be a voice for ORRI in your institution. Share your successes, advocate for supportive policies, and inspire others to follow suit.
4. **Stay Resilient and Adaptive**: Challenges like funding gaps or institutional resistance may arise, but with the tools, resources, and strategies outlined in this guide, you can navigate these barriers effectively.
5. **Measure Your Impact**: Continuously reflect on your progress, document milestones, and evaluate how your research aligns with ORRI principles. This not only strengthens your practice but also showcases your leadership in responsible research.

The Future of ORRI in the Balkans

The adoption of ORRI principles in the Balkan region is more than just a personal or institutional goal—it is a regional movement with the potential to enhance the societal value of research, build trust in science, and position the region as a leader in responsible innovation. Young researchers are at the heart of this movement.

By implementing the practical steps and advocating for supportive policies outlined in this guide, you are contributing to a research culture that is open, inclusive, and impactful. Together, the Balkan region can become a hub of innovation that aligns research excellence with the values and needs of its society.

The next steps lie with you—the researchers, innovators, and changemakers. Embrace this opportunity to lead with purpose and responsibility, and let your research make a difference for generations to come.

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Funded by the European Union

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