significant opportunities for import replacement, as well as export of specialised bio-based oils.

5.1.4 Strategic Thematic Area 4: Sustainable Energy

***Strategic Objective 4**: To increase the* production and use *of sustainable bioenergy and develop a range of bioenergy products for both household and industrial purposes.*

Bioenergy is energy for industrial or commercial use that is derived from biological sources (such as plant matter or animal waste). It includes energy from wood, wood waste, straw, manure, sugarcane, and many other by-products from a variety of agricultural processes that are currently under-utilised or utilised in an inefficient manner in the region.

Modern bioenergy is an important source of renewable energy. However, it is essential to ensure that crop production for biofuels does not impact on food production (the "food vs fuel" debate). Nevertheless, rural regions of East Africa offer significant opportunities for expansion of biomass production that can create value-added at low opportunity cost by improving degraded or poorly maintained lands. There is a high potential to use part of the crop and pastureland that are currently very inefficiently used for bioenergy purposes and at same time increase the productivity of existing agricultural production systems. The African Union and countries in East Africa are developing a Bioenergy Development Strategy and Investment Plan, and this Thematic Area supports its operationalisation. Activities under this STA will also be supported by the work conducted by the Global Bioenergy Partnership in Kenya and Ethiopia.

KRA 4.1: Biomass briquettes as alternative to charcoal and firewood
***Strategic Objective 4.1**: To promote initiatives in briquette production from waste materials to substantially reduce the unsustainable use of wood fuel.*

Firewood and charcoal alone provide more than 40% of energy used in Africa, and about 80% of households on the continent depend on wood and charcoal as a primary energy source. For example, the energy balance of Tanzania shows that petroleum and electricity account for only about 8% and 1.2%, respectively, with biomass use accounting for over 90% of energy consumption and continues to dominate as the main source of energy[37].

Biomass briquettes, mostly made from agroprocessing, agricultural and forestry residues, are increasingly popular in East Africa (and Africa generally) as an alternative fuel to charcoal and firewood, providing heat for cooking (and lighting). By turning organic waste into clean-burning biomass, use of briquettes helps save forests and biodiversity, and cuts greenhouse gas emissions. It also reduces the levels of indoor pollution in households which is responsible for deaths of an estimated 15,000 women and children annually in Kenya alone. There are already some factories in the region producing more than 2000 tonnes of briquettes a year from waste materials, but the potential is much greater than this. Work in this KRA will focus on scaling the production of biomass briquettes and improving and extending their industrial use, by refining the technology and developing the supply chain, together with development of improved cooking stoves. It will build on many on-going (but relatively small)

[37] IEA. 2019. Africa Energy Outlook 2019 World Energy Outlook Special Report. International Energy Agency Publications, 288. Retrieved from www.iea.org/t&c/

initiatives across the region[38].

Box 8: Briquettes and pellets as sustainable and modern energy carriers.
The East Africa region has large potential to produce modern bioenergy from a variety of biomass feedstock resources, including forest and agricultural residues, energy crops and the organic component of municipal solid waste. Briquettes and pellets produced from, agroprocessing, agricultural and forest residues such as sugar cane and pineapple bagasse, coffee, maize, and sawdust among others provide a more sustainable alternative to unsustainable firewood and charcoal production causing deforestation. Apart from being more efficient energy carriers, the use of briquettes and pellets also results in improved indoor air quality and human health. The technology used depends on the production scale, ranging from informal operations to large industrial operations. There is an average production of sawn wood in the region of around 970,000 cubic meters with an estimated 120,000 cubic meters of residues with potential use for briquettes and pellets or in combination with other agricultural or forest residues. Other material that is readily available is sugar cane bagasse. The average production of bagasse is around 5.5 million tonnes per year. The production of briquettes and pellets is still low in the region but could be expanded for use for the industrial market including the tea, coffee vegetable oil, and food processing sectors and other sectors that use boilers in their processes. The technology used depends on the production scale, ranging from informal operations to large industrial operations.

Potential impact: Tanzania alone uses one million tonnes of wood charcoal each year, resulting in unsustainable deforestation, so the regional market is huge for sustainably produced briquettes as an alternative. Small scale rural initiatives to produce briquettes could create employment for youth in rural areas where it is most needed and thereby reduce the migration into cities.

KRA 4.2: Production of biogas from organic waste

Strategic Objective 4.2*: To stimulate and support uptake of biogas technologies in the region at both household and industrial levels.*

Biogas is produced from anaerobic digestion of organic waste and consists primarily of methane and carbon dioxide. Small scale production of biogas from household digesters is growing in popularity in the region. The African Biogas Partnership Program (ABPP) has established a nascent industry for bio-digesters in Tanzania, Uganda, and Kenya. While the biogas is used for cooking, a secondary benefit is increased crop yields from the resulting bio-slurry. However, barriers still exist that hamper large scale dissemination, including high installation costs, inadequate user training, insufficient servicing, and inappropriate designs. Poor design choices, mainly due to overlooking the user energy needs and local conditions, contribute to the short lifespan of many installed biogas systems.

There are also opportunities to recover biogas at a larger scale from sources such as municipal waste systems, for electricity generation and for public transportation. By inserting a series of pipes into landfills at various depths, the biogas produced through natural

[38] UNEP. 2020. Sustainability Of Sugarcane Bagasse Briquettes And Charcoal Value Chains In Kenya http://www.globalbioenergy.org/programmeofwork/working-group-on-capacity-building-for-sustainable-bioenergy/activity-group-2/iki2-ethiopia-kenya/it/

decomposition can be collected and harnessed. While the potential for this is large, enhanced uptake requires incentives to be in place such as electricity feed-in tariffs and tax incentives. Furthermore, through innovation supported by scientific research, bio-hydrogen can be extracted from biogas and biomass and compressed into liquid hydrogen to be used as environmentally friendly biofuel.
This KRA will seek to further the growth of biogas production and utilisation at all scales to address the current barriers and reach more of the population in the region.

Potential impact: As a source of renewable energy, scaling biogas use will have a considerable contribution to reduction of greenhouse gas emissions and reduction in unsustainable use of wood fuels.

KRA 4.3: Advanced biofuels
Strategic Objective 4.3*: To support the development of biofuels produced from lignocellulosic materials and algae.*

Second generation biofuels are produced from non-food crops and agricultural and forest residues. In the case of some crops, such as sweet sorghum, there may be synergies with food production. For other lignocellulosic crops grown specifically for biofuel production, the choice of crop is important in avoiding conflicts in the supply of food, energy, and water. Nevertheless, rapidly emerging novel conversion technologies of forest and agroprocessing residues provides a great opportunity for future development of biofuels in the region. A wide range of conversion options is available, the most widespread being the production of liquid fuels (bioethanol and biodiesel) for transportation.

As a prospect for the longer term, biofuels are now being developed from microalgae. They are an ideal biofuel feedstock because of their rapid growth rate and greenhouse gas sequestration ability (net zero emission balance). They also do not compete with food or feed crops and can be grown on non-arable land and saline water. Technologies for their production and harvesting are still under development but offer future promise. Work in this KRA will focus on developing and implementing small scale second and third generation technologies that are financially viable and can be implemented at community level.

Potential impact: To date, there has been very limited production of advanced biofuels in the region, in part due to high capital costs and land tenure issues. However, in the longer term, small scale rural production offers opportunities for job creation for young people.

6. Key Strategic Enabling Actions

Strategic enabling actions are required to help translate the strategic intentions in Chapter 5 into programmes, and ultimately into outcomes and impacts.

The key enablers for successful delivery of the East Africa Bioeconomy Strategy will include: a) enabling policy environment ensured by enacting and harmonising policies and legislation in the region to support biosciences training and research, bio-innovation, and bio-businesses; b) enhancing the bioeconomy innovation system including facilitating the connection of entrepreneurs, especially start-up businesses, to affordable financing; c) capacity development in all areas of the bioeconomy; d) catalysing relevant and productive partnerships and collaborations to drive bio-innovations and bio-businesses, and e) effective

leadership and communication to facilitate coordinated and effective implementation within and across countries in the region.

This chapter presents a summary of these enablers, with specific examples of interventions that must be undertaken under each operational enabler.

6.1 Policy and legislation

Action required: *Policy makers should create an enabling policy environment in East Africa for the emergence of bioeconomy as a major driver for environmentally sustainable and inclusive economic development.*

Central to the development of a functional bioeconomy in East Africa will be the creation of demand for biobased products. In its 2019-2024 "*market analysis and forecast*", the International Energy Agency (IEA) identifies policy and regulatory uncertainty, as well as high investment risks as critical determinants of growth in the (bio) energy sector in developing countries. Policies and regulations that clearly benefit innovation and deployment, not only on the supply side, but also on the demand side will be crucial for successful delivery of the Bioeconomy Strategy in the region. Demand can be supported through: conducive long-term policies; efficient national regulatory systems; and appropriate incentive systems, including policies on banning /phasing out plastics, supporting SME growth, manufacture and use of locally made products, and enhancing ease of doing business, supporting actions to reduce Green House Gas emissions and mitigation of climate change, and regulations that foster rather than stifle innovations in support of the bioeconomy, and those that increase biobased trade – within and outside the region.

Regulatory frameworks for intellectual property, the access to and use of genetic resources, biosafety and the ethics of biosciences and industrial standards will need to be examined. While there are a variety of existing policies and strategies at regional and national level that are relevant for bioeconomy development, as listed in regionally in Annex A and including, for instance, National Biodiversity Strategies and Action Plans formulated under the Convention on Biological Diversity, gaps remain in policy and strategy coherence and implementation.

Effective governance will require interdisciplinary assessments and a consideration of insights from a broad set of scientific disciplines, including environmental, social, and economic disciplines. Effective regulatory oversight that does not stifle bioscience innovation needs to be balanced against public pressure for stringent and demanding regulations. Globally agreed standards on the measurement and definition of biobased products — such as their carbon footprint and sustainability— will need to be in place.
An independent and non-partisan certifying and testing body will need to be put in place to establish public confidence and enable countries that lack capacities to benefit from the results. But the policies must be informed by a deep understanding of the needs and aspirations of the region, and to be translated into practices which are reflective of the local contexts and priorities of individual countries and their expectations related to the bioeconomy.

Box 9 provides examples of some of the policy and legislation initiatives that, if addressed, will unlock the potential of bioeconomy in the region.

Box 9: Examples of Bioeconomy-related policy issues	
Sector	**Examples of policy/legislative issues to be addressed**
Food and Agriculture	● Countries are moving at different paces regarding acceptance of novel bioscience techniques to modify and tailor make various genetic resources. This includes new development of biotechnology crops through genetic modification (GM) or genome editing which is increasingly used to increase feedstock yields, net energy gain, and generation of high-value co-products. Legislation is lagging technology development, with new breeding technologies that blur the boundaries of genetic modification. Depending on needs, aspirations, and willingness to promote innovation in this area policy makers need to consider how to ensure that regulations, including GM legislation can keep pace with the rapid technology development. ● Common policies and regulations supporting (not stifling) development and deployment of biobased agrochemicals (e.g., biopesticides, growth promoting biologicals), including standards, ensuring product efficacy and safety, are required. ● The region lacks clear and coherent standards for novel food products and this can hamper innovation on novel foods. Regional harmonisation of food safety and food content regulations is also important for regional trade, not least to safeguard against mycotoxin contamination of food and feed which is a major problem in the region and has an impact on the potential for food value chain development and trade. ● The agriculture sector needs to be generally improved, with attention paid to issues of sustainable intensification, land tenure, governance, extension services etc.
Energy	● Regional clean energy policy: Countries need to move in a synchronised manner towards clean energy, considering likely cost differences among alternative energy sources. ● Conditions must be created to make bioenergy competitive through appropriate incentives: Currently biofuels are often less competitive than solar and wind.
Health	● The EAC is currently aiming to harmonise the systems for registration of human and animal medicines in the region. Disparate medicines regulatory regimes hamper the provision of quality health care. ● Costs and delays in product registration, and the prevalence of counterfeit drugs, must be addressed to facilitate the introduction of new products. ● Requirements for safety and efficacy data, as well as registration systems, for traditional medicines, must be clarified and implemented. Many plants used in traditional medicines are being unsustainably harvested from the wild. ● Policies on how information gathered from traditional medicine may be used as a starting material in the synthesis of conventional medicine should be clarified. Furthermore, countries should streamline their access and benefit sharing regimes.

Environment	• Measures designed to prevent or reduce harmful effects of human activities on the environment, and the protection of natural resources, need to be aligned between countries and adequately enforced. • Plastics vs bio-packaging - balancing environmental impact vs cost, and the need to harmonise policies and practice given the regional trade and citizen movements. Standards and guidelines for bio-packaging materials are needed. • Targeted interventions are needed that support the Paris Climate Change agreement on reducing Greenhouse Gas emissions and mitigating climate change.
Intellectual Property (IP)	• While IP is protected by law (through patents, copyright, trademarks, etc.), for benefits to accrue to inventors, the region will need acceptable systems (policies and practice) that help strike the right balance between the interests of innovators (including public and private institutions) and the wider (regional) public interest, while still fostering an environment in which creativity and innovation can flourish. Access to global intellectual property and knowledge needs to be improved to ensure that the region benefits from new emerging technologies. In the case of traditional knowledge and genetic resources, the region will require the introduction of appropriate regulations to ensure that indigenous knowledge systems are protected and that the conditions of the Nagoya Protocol on Access and Benefit Sharing are adhered to.
Business environment	• Policies are needed that support SME growth, and ease of doing business, incentivising the bio-businesses. • Regional integration through the creation of common markets for biobased products, needs to be developed to support biobased economic growth in the region. • Consideration needs to be given to ensure that import tariffs, such as for bioprocessing equipment, are not punitive. • Public procurement regimes catalysing and supporting the development of biobased value chains and sustainable production need to be developed.

6.2 Capacity strengthening

Action required: *Build human and infrastructural capacity for research, entrepreneurship and business development required to drive strong bioeconomy value chains in the region.*
Inadequate technical training, poor access to research facilities, and lack of strategic partnerships with other African and international research institutions are some of the major capacity constraints the region faces. Beyond human capacity and R&D infrastructure, entrepreneurial skills and competencies are critical for good ideas to move through to commercialisation. These include the ability of companies to embrace disruptive ideas, and the attitude toward entrepreneurial risk.

New and rapidly emerging technologies will continue to provide opportunities for improving biobased production and value chains. The region will need to build human and infrastructural capacities to access and harness these strategically important technologies and adapt them to local needs. Such a capacity could be built at a regional level through regional centres and service platforms. Building on lessons learnt from existing regional biosciences platforms such as the Biosciences East and central Africa (BecA) Hub based at the International

Livestock Research Institute (ILRI) in Nairobi, Kenya, the region will invest in creating robust biosciences platforms – which provide cutting edge technologies - based on institutional arrangements that ensure ownership, affordability, and access by national scientists.

The private sector in East Africa is crucial in the endeavour to build bioeconomies, and key to search for and exploit market opportunities. However, the private sector in East Africa is still weak, particularly around biobased enterprise development and therefore, on its own, is largely unable to drive the innovation needed for bioeconomy development. The establishment of new, and strengthening of existing, business incubators is essential. These incubators will seek to provide collaborative work environments for entrepreneurs, helping them transition from start-ups to independence. Incubator services will include financing facilities and business training courses, as well as in-house services—such as research and development, legal and accounting services which may be too costly for start-ups.

Other services will include physical working spaces, proof of concept support, market testing, business setup, and manufactured products or software assistance. In addition, just as it is important to catalyse cross-disciplinary networks bringing researchers and practitioners from different backgrounds together to share ideas and exchange experiences, start-up businesses also need support in networking.

Box 10: Building new Bioeconomy knowledge platforms.

Generating, promoting, and adopting innovations, technologies, and techniques to convert biomass into goods of higher value and to valorise the primary produce in the region is dependent on scientific and technological skills. These skills are largely inadequate in the region, and capacity building in this field can be enhanced by building shared knowledge platforms. Specific facilities that constitute a 'decentralised platform' could be spread across countries by commodity and/or thematic areas, following the model that was piloted under the East Africa Agricultural Productivity Project (EAAPP), funded by the World Bank. But the new platforms need to be designed to drive '*research into use'* where multi and -inter-disciplinary links are fostered as well.

Links with NARIs and universities will be a major means of ensuring continuing relevance of the science being taught and its application. In this connection, regional initiatives such as the flagship TAGDev program of RUFORUM – which *seeks to transform African agricultural universities and their graduates, to respond better to developmental challenges through the enhanced application of science, technology, business, and innovation for rural agricultural transformation* – will be important implementing partners. Working with universities to develop and/or review graduate programs to ensure continuing context relevance that reflects both the developments in the science and the evolving needs in the region will be important in this regard.

The priority intervention areas are summarised in **Box 11**.

Box 11: Priority areas for capacity strengthening	
Sector	**Actions required**
Science and technology institutions and universities	● Coordinate current institutional arrangements in terms of their mandates, functions, and activities in respect of bioeconomy-related issues. ● Strengthen key institutions and encourage collaboration both regionally and nationally. ● Maintain highly trained academic staff at public R&D institutions offering competitive remuneration and career opportunities.
Human capacity	● Enhance capacity in modern biosciences and related technologies, including synthetic biology, nanotechnology, and bioinformatics, digitalisation, and block chain technologies. ● For the health sector, build expertise in drug development, clinical trials, and regulatory aspects. ● Strengthen capacity in bioprocess engineering and valorisation of primary produce, including the construction and engineering of highly efficient and sustainable bioprocessing facilities of different scales, including modern biorefineries. ● Build know-how in entrepreneurship at public sector institutions, including business planning and business management. This needs to go hand in hand with policies and incentives for staff to develop spin-off businesses.
Business development	● Stimulate business to business (B2B) collaboration, including supporting private sector actors with business development. ● Provide professional business incubation services to assist innovation actors with business development and commercialising promising products and technologies. ● Establish and/or strengthen technology transfer offices in universities and research institutes to provide support for techno-economic analysis, IP management, and linkage with the private sector. ● Organise technology fairs to provide an opportunity for entrepreneurs and potential investors to link up. ● Support community driven value addition processes. These could be in the form of co-operatives, or formation of smallholder-based companies specialising in value addition to a specific bio-resource or a range of bioresources.
Infrastructure	● Develop biorefinery structures and agro-industrial development centres, including the development of local and community-based bioprocessing structures. ● Establish knowledge centres and/or clusters for specific value chains such as waste conversion, biofuels etc.

6.3 Financing

Action required: *Facilitate access to appropriate financing to support implementation of priority strategic initiatives that deliver or catalyse the delivery of regional bioeconomy outcomes and impacts.*

Access to capital and credit facilities under reasonable terms is critical for innovation and for realising the bioeconomy vision in the region. Public funding (from national budget allocations and funding agencies) is often the base for R&D efforts in the public sector and academia. But, to successfully bring R&D products or innovation of new bio-products to market, mechanisms to share risks and new funding partnerships are necessary, in which innovation, risks and business development costs are borne by several different parties. Lack of funding continuity and an inadequate understanding of the capital requirements to bring an innovation to market frequently lead to gaps in the innovation chain. Access to long-term support and capital, enabling the innovation processes for the development of biobased products in an iterative manner, is therefore a crucial success driver of the Bioeconomy Strategy. Creative financing models will need to be explored. For example, matched funding programs could be developed, in which R&D institutions co-invest with industry partners, thereby ensuring commitment from industry and reducing risks for all parties. In many donor-funded projects, funding remains concentrated in the R&D phase of the innovation cycle, with inadequate provision made for large-scale application and commercialisation of technology or products. For innovation to have impact and assist the region to move towards a bioeconomy, a range of funding models for sharing costs and raising necessary capital will be needed. Examples include: Regional and national public sector innovation funds; venture capital; philanthropic investments; blended financing mechanisms, etc. The African Development Bank (AfDB) will be an appropriate partner in this endeavour.

Box 12 presents examples of tailor-made financing mechanisms that could be developed to support bioinnovation towards commercial application.

Box 12: Examples of targeted financing along the innovation delivery chain

Financing mechanism	Actions required
Technology Gateway Funding	Industry-led research in emerging technology areas, and initiatives to deliver technology solutions for industry through collaborative industrial projects.
Small Business Innovation Research Funding	Engagement of public sector with technology-rich companies and organisations.
High Potential Start-up Feasibility Fund	Assist early-stage company or individual entrepreneur to investigate viability of a new business or proposition.
Innovation Partnership Fund	Assist collaborative projects between companies and research teams in tertiary education institutions (possibly with graduate training component).
High Potential Start-up Fund	Provide support for start-up businesses with potential to develop innovative product or service for sale on international markets.
Accelerator Fund	Support for entrepreneurs to launch market-changing companies – i.e., early investment to selected companies with well-defined plans for a technology-based product or service.

Innovation Vouchers	Provide modest grants (e.g.US$10,000) to get innovative solutions to a specific technical and business challenge.

6.4 Coordination and Partnerships

Action required**:** *The EAC must provide leadership and support to the development and deployment of well-coordinated, functional innovative partnerships and collaborations at national, regional, continental, and global levels needed to create a thriving and sustainable bioeconomy across East Africa that leverages on available science, technologies and innovations and has access to critical capacity and financing it needs.*

Effective regional collaboration will be crucial to delivering the objectives of the Bioeconomy Strategy. This will require an understanding of the ever-changing contexts and needs of individual countries and their economic development expectations. A robust coordination and partnership function will be a critical strategic enabler. This Strategy proposes a lean, but-fit-for-purpose, coordination and partnership arrangement that will provide leadership and coordination to drive implementation. This will include, among other things, fostering stakeholder engagements, creation of enabling policy environment, resource mobilisation, strategic partnership and collaboration arrangements, communication about the bioeconomy, and catalysing programme development and implementation mechanisms that are seamlessly integrated into national programming and not seen and treated as separate 'regional projects'. Importantly, this function will ensure on-going *relevance, effectiveness, efficiency,* and *sustainability* of programming at regional level.

Relevance: Actions to align objectives and design of bioeconomy programmes and interventions within them (including policies and practice, as well as financing) with the: (i) challenges and concerns relevant for the contexts of the region and individual countries; and (ii) the specific needs, concerns, and priorities of countries. Relevance of bioeconomy programming will be compromised when: either the supply or the demand for specific regional programs are not well founded; when the program activities at regional level compete with or substitute for activities that individual countries can do more efficiently; or when the program design and implementation is inappropriate for achieving the objectives. Thus, to achieve continuing relevance of programs the coordination and partnership entity will need to ensure that formulation and implementation processes pay due and adequate attention to the challenges, concerns, and priorities of individual countries, including capacities.

Effectiveness: Coordination will also ensure that programmes deliver their stated objectives. Supporting flagship national and regional programmes to undertake analysis of the extent to which projects/programs meet or fail to meet their intended deliverables/targets, and paying special attention to the identification of both success and failure factors will be a crucial function, especially in the early stages of flagship bioeconomy programmes. Lessons-learning across the region aimed at design and process improvements will be part of this function.

Efficiency: Efficiency function will aim to ensure that resources or inputs (finances, expertise, time, etc.) are converted to results in the most economical manner. This will include analytical support to both regional and national programmes so that the least costly resources that are appropriate and available are used to achieve the desired results or deliverables. As the region begins to roll out major initiatives in bioeconomy, many programmes will be entering

'new territory' and will need support in ensuring resource use efficiency. Addressing duplication of efforts and conflicting investments will be crucial. Good practice analyses, that is, lessons learned from similar endeavours, will be used as benchmarks for assessing efficiency. Close attention will need to be given to coordination and collaboration among countries, especially putting in place practices that pay close attention to opportunities for synergy and complementarity in programming.

Sustainability: Sustainability of the bioeconomy will include all aspects of production, value addition and consumption of biobased products, and include environmental, social, and economic sustainability. Good governance and evidence-based assessments and decision making are also vital components in building a sustainable bioeconomy. Sustainability will be measured as the ability of programme results (outcomes and impacts) to be maintained and scaled for wider use beyond '*project, pilot or demo phase'.* Achievement of sustainability will be evidenced by economic prosperity that can be linked to the realisation of the objectives of this Strategy. In this regard the coordination and partnership functions will be responsible for actions to ensure that countries in the region are individually and together as a block on a consistent journey towards policy and practice that foster an ecosystem of discovery, innovation and commercialisation, and that biobased business enterprises are emerging, thriving, creating jobs and generating solutions that address the most pressing environmental and human livelihood challenges, and improving quality of life. In addition to policy environment, appropriate financing and partnerships will be crucial underpinnings for achieving this desired sustainable, bioeconomy-driven, economic prosperity in the region.

Overall, to deliver on this function, some of the overarching activities to be undertaken will include:

- On-going analysis of trends at country, regional, continental, and global levels that have implications (e.g., they present challenges and opportunities) for bioeconomy programming in the region.
- Working with member countries and engaging with key stakeholders to ensure that changing country contexts and needs inform regional bioeconomy programs and programming approaches.
- Identification of partnerships, including Public-Private Partnerships, (PPP) and other institutional arrangements to improve programming, including to address or harness emerging challenges and opportunities.
- Identifying and addressing duplications and facilitating programming arrangements that optimise exploitation of synergies.
- Identification of resources and matching resourcing models to contexts and needs

6.5 Communication and awareness raising

Action required: *To build an understanding amongst the key actors and the general population of the region about the concept of a bioeconomy, the need for its development in the region, and its contribution to the Sustainable Development Goals and combatting climate change.*

Communication plays an increasingly important role in innovation, and is particularly important in the development of a bioeconomy. It is not a one-way process, but requires a constant dialogue between science, business, and society. Efforts to encourage stakeholders to participate in evidence-based discussions are needed that also allow for discussion of broader issues such as socio-cultural, political, and ethical concerns. Communication is