

## ANNEX 11: THEORETICAL FRAMEWORK FOR RBs BUSINESS MODEL

Business models can cover different parts of the sewage sludge management (Figure 1)<sup>1</sup>:

- Infrastructure access;
- Emptying and transport of sludge from septic tanks;
- Sludge treatment;
- Sludge reuse;
- Energy recovery.

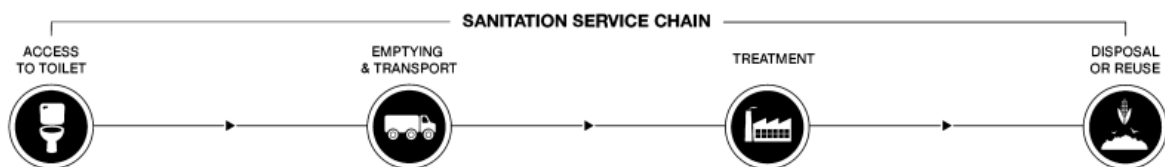


Figure 1: Sanitation service chain<sup>2</sup>

According to the study "Characterizing nature-based solutions from a business model and financing perspective (2017)"<sup>3</sup> NBS can create, deliver and capture value. As shown in the Figure 2, three aspects (value proposition, value delivery, and value capture) of NBS-related BM model impact the type and structure of finance that can be obtained and fit the NBS characteristics.<sup>3</sup>

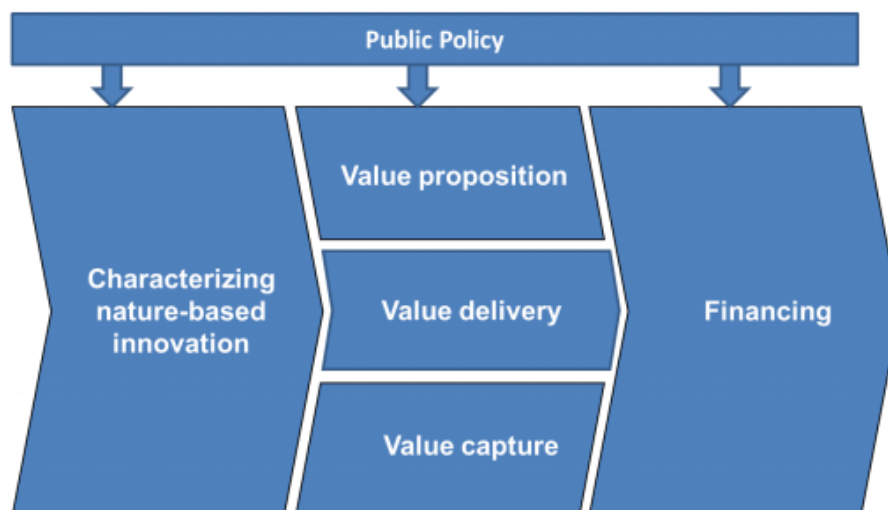


Figure 2: Proposed analytical framework for NBS<sup>4</sup>

Identified aspect, which generates value on RBs, is providing treatment for the recovery of nutrients. The presented business model (BM) is built around the following value proposition: **reuse through**

<sup>1</sup> [https://www.afwkm.com/wp-content/uploads/2019/06/Business\\_models\\_for\\_fecal\\_sludge\\_managem-1.pdf](https://www.afwkm.com/wp-content/uploads/2019/06/Business_models_for_fecal_sludge_managem-1.pdf)

<sup>2</sup> [https://www.afwkm.com/wp-content/uploads/2019/06/Business\\_models\\_for\\_fecal\\_sludge\\_managem-1.pdf](https://www.afwkm.com/wp-content/uploads/2019/06/Business_models_for_fecal_sludge_managem-1.pdf)

<sup>3</sup> [https://naturvation.eu/sites/default/files/news/files/naturvation\\_characterizing\\_nature-based\\_solutions\\_from\\_a\\_business\\_model\\_and\\_financing\\_perspective.pdf](https://naturvation.eu/sites/default/files/news/files/naturvation_characterizing_nature-based_solutions_from_a_business_model_and_financing_perspective.pdf)

<sup>4</sup> [https://naturvation.eu/sites/default/files/news/files/naturvation\\_characterizing\\_nature-based\\_solutions\\_from\\_a\\_business\\_model\\_and\\_financing\\_perspective.pdf](https://naturvation.eu/sites/default/files/news/files/naturvation_characterizing_nature-based_solutions_from_a_business_model_and_financing_perspective.pdf)

**nutrient recovery - producing high-quality compost as a soil amendment.** Resource recovery allows the possibilities to apply market-based principles, at least on parts of the service delivery chain, where waste can offer incentives for business development and cost recovery<sup>5</sup>.

Having defined the BM value proposition, next step is to identify other key elements of BM for biosolids reuse (Figure 3).

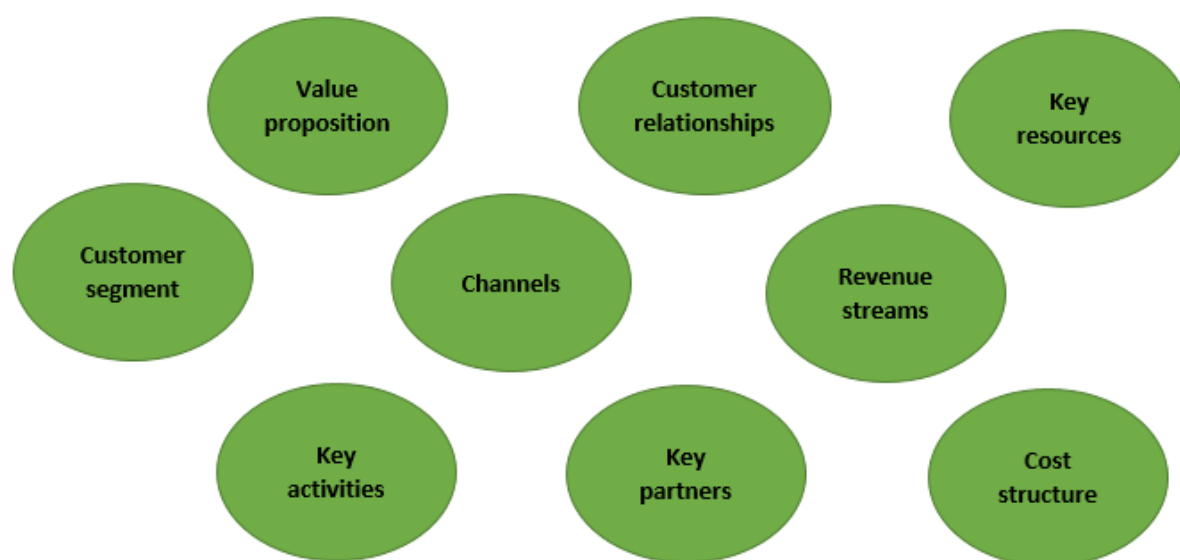


Figure 3: Business model canvas<sup>6</sup>

The business model canvas describes how a business creates, delivers, and captures value. Hence, it helps the business develop an operational process of providing a product or service to a target customer segment.<sup>7</sup> In Table 1 theoretical canvas of BM for biosolids reuse is presented.

Table 1: Theoretical canvas of BM for biosolids reuse

<b>Key partners</b>	Top-down: <ul style="list-style-type: none"> <li>• Responsible national/regional/sector authorities related to biosolids reuse</li> <li>• RBs owner – municipality</li> <li>• RBs operator – public utility</li> <li>• Technological expert</li> </ul>
<b>Potential customers</b>	<ul style="list-style-type: none"> <li>• Farmers</li> <li>• Agricultural sector</li> <li>• Forestry sector</li> <li>• Landscape sector</li> <li>• Fertilizer industry</li> </ul>

<sup>5</sup> Murray, A.; Buckley, C. 2010. Designing reuse-oriented sanitation infrastructure: The design for service planning approach.

<sup>6</sup> [https://www.afwakm.com/wp-content/uploads/2019/06/Business\\_models\\_for\\_fecal\\_sludge\\_managem-1.pdf](https://www.afwakm.com/wp-content/uploads/2019/06/Business_models_for_fecal_sludge_managem-1.pdf)

<sup>7</sup> [https://www.afwakm.com/wp-content/uploads/2019/06/Business\\_models\\_for\\_fecal\\_sludge\\_managem-1.pdf](https://www.afwakm.com/wp-content/uploads/2019/06/Business_models_for_fecal_sludge_managem-1.pdf)

<b>Customer relationships:</b>	<ul style="list-style-type: none"> <li>• Direct biosolids sale</li> <li>• Distributors</li> </ul>
<b>Key activities</b>	<ul style="list-style-type: none"> <li>• Biosolids production</li> <li>• Biosolids monitoring (analysis)</li> <li>• Biosolids sales and marketing</li> <li>• Biosolids relationship management</li> </ul>
<b>Key resources</b>	<ul style="list-style-type: none"> <li>• Appropriate technology and equipment/machines</li> <li>• Labour</li> <li>• Know-how</li> <li>• Supportive environment</li> <li>• Finance</li> <li>• Licenses<sup>8</sup></li> </ul>
<b>Sale channels</b>	<ul style="list-style-type: none"> <li>• Municipality and public utility</li> <li>• Local communities</li> <li>• Unions, cooperatives</li> <li>• Word-of-mouth</li> <li>• Awareness rising activities</li> <li>• Commercial advertising</li> </ul>
<b>Cost structure</b>	<ul style="list-style-type: none"> <li>• Investment cost</li> <li>• O&amp;M cost</li> </ul>
<b>Revenue streams</b>	<ul style="list-style-type: none"> <li>• Sale of biosolids</li> </ul>
<b>Social and environmental benefits</b>	<ul style="list-style-type: none"> <li>• Improved soil</li> <li>• Improved agricultural productivity</li> <li>• Reduced pollution of water sources</li> <li>• Job creation</li> </ul>

BM conceptualize sustainable biosolids reuse chain as illustrated in the Figure 4.

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<sup>8</sup> If required by national standards



Figure 4: Conceptualized biosolids reuse chain

Characteristics of RBs to influence the generated value and the way it can be delivered by a government or business entity are specific. In addition, BM has to consider **regulations, technical feasibility, and ownership questions**. Towards the end of the service chain, as the reuse of biosolids is positioned, engagement with different stakeholders with varying interests increases. Reuse standards are based on the type of end product that impacts stakeholder interests, incentives, commitment, and chain collaboration. Thus, service with regards to nutrient recovery is more challenging to implement and regulate.

**Barriers** to the commercial exploitation of biosolids are mostly identified in the socio-economic and policy rather than biophysical challenges<sup>9</sup>. Key barriers related to biosolids distribution and selling are<sup>10</sup>:

- Perception of the product since it is made from fecal matter;
- How do I certify that my product is safe;
- How much compost to apply on which soil and crop;
- What is the product's quality in comparison to known products (manure, fertilizer, and other compost).

BM success depends on its ability to address and overcome above-listed barriers between diverse **key actors** (WWTP owners/operators, sectoral authorities and agencies, policy-makers, decision-makers, businesses, sellers/distributors, local communities, etc.).

<sup>9</sup> [https://naturvation.eu/sites/default/files/news/files/naturvation\\_characterizing\\_nature-based\\_solutions\\_from\\_a\\_business\\_model\\_and\\_financing\\_perspective.pdf](https://naturvation.eu/sites/default/files/news/files/naturvation_characterizing_nature-based_solutions_from_a_business_model_and_financing_perspective.pdf)

<sup>10</sup> [https://www.afwakm.com/wp-content/uploads/2019/06/Business\\_models\\_for\\_fecal\\_sludge\\_managem-1.pdf](https://www.afwakm.com/wp-content/uploads/2019/06/Business_models_for_fecal_sludge_managem-1.pdf)

**Cost recovery** for biosolids reuse is, in principle, derived from revenues that can be made by selling the final product (Figure 5). Besides trade, other sustainable cost recovery mechanisms for sanitation are water tariffs (collected from water users), taxes (raised through the tax system) and transfers (raised funds from donors, etc.).

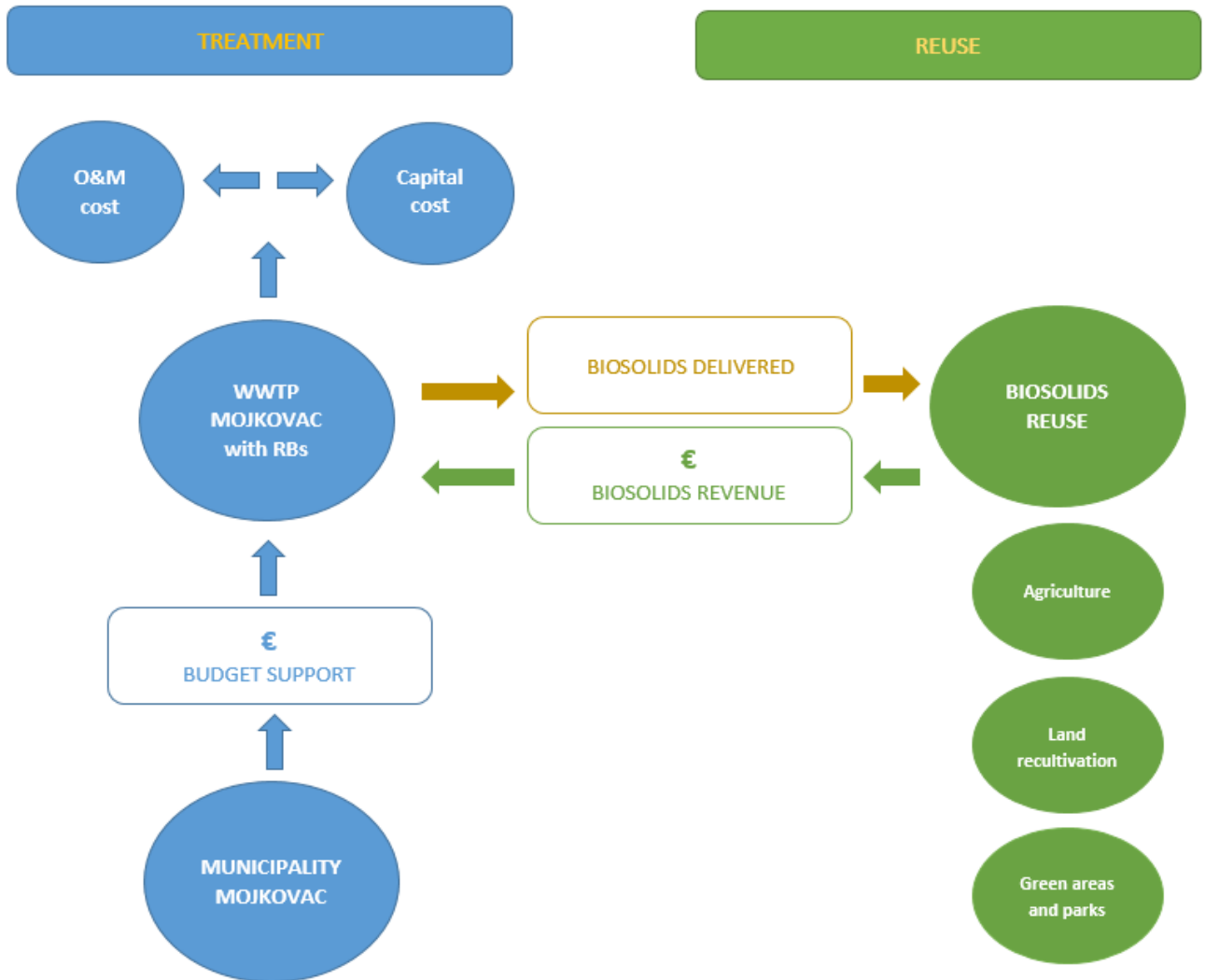


Figure 5: Financial flows of BM for biosolids reuse

A well-designed BM for biosolids reuse presents an excellent opportunity to decrease the overall costs of the wastewater (sludge) treatment services. RBs do not increase the WWTP complexity and even reduce O&M costs, but require higher initial investment costs and expertise related to biosolids reuse application.

The revenues generated from nutrient recovery have the potential to (possible selection):

- cover the reuse (excavation of material, transferring it to the site and land application);
- reduce the monthly fee for wastewater services (water tariff);
- cover all or part of the O&M costs of RBs;
- cover all or portion of the initial investment costs in RBs;
- cover the difference arising between higher investment costs in RBs and lower investment costs of competing technology.

Cost recovery varies within the regional context depending on the market selling price of fertilizer, buyer's willingness to pay, local acceptance of the biosolids, and competition in the fertilizer industry.

If the market and selling price of the resource generated is not sufficient to cover at least the additional O&M cost related to reuse, reuse can become a burden, causing the business to incur a financial loss.<sup>11</sup>

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<sup>11</sup> [https://www.afwkm.com/wp-content/uploads/2019/06/Business\\_models\\_for\\_fecal\\_sludge\\_managem-1.pdf](https://www.afwkm.com/wp-content/uploads/2019/06/Business_models_for_fecal_sludge_managem-1.pdf)