Reusable Building Blocks for Agent-Based Modelling – Instruction sheet

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1. Background

1.1. Context

Reusable Building Blocks (RBBs) are modular, self-contained components used in agent-based modeling to represent specific processes or mechanisms. They are designed to be easily integrated into larger models, allowing for the efficient construction and adaptation of complex simulations. RBBs enable modelers to reuse established, well-tested components across different projects, ensuring consistency and reducing development time.

For these purposes, we have developed a framework that enables agent-based modelers to communicate their reusable modules in a standardized way. The RBB framework links specific implementations in agent-based models to corresponding underlying theories, making the assumptions made in the process explicit. In the future, we are hoping to build a database of standardized RBBs that can be used by agent-based modelers to reduce the time spent on reinventing the wheel by writing the same model components over and over again.

1.2. Goal

You are asked to develop an RBB for a specific aspect of the adaptation process, ranging from individual decision-making theories to broader social and policy influences. This RBB should be a well-defined, modular component that can be integrated into the larger agent-based model of urban flood adaptation.

Your goal is to develop an RBB that can be reused by other modelers in their agent-based models. It is important, thus, that you think about the usefulness of your implementation to others (Does it generalize to other situations? Why, or why not? What design choices do you make and why?). Another important aspect is the modularity of your RBB: to what extent can it be separated from the rest of your model, and how can your implementation best reflect this? There are no wrong answers, just think about the implications of your choices and have these reflected in the description of your RBB.

1.3. Guidelines and grading

For this part of the project, your group must develop an RBB of a specific aspect of the the flood adaptation agent-based model (see Appendix A of the course assignment).

The RBB must be submitted on our website: https://www.agentblocks.org (*Please do not access the website or create an account before Wednesday 29 November. The website is currently under maintenance*). You can submit your RBB following the instructions provided in the project description. You should include the "Title" and "Authors" of your RBB so that we know which one is yours. You do not have to include any other information regarding the RBB in your report.

Providing an RBB is mandatory, but will bee assessed based on completeness. The best RBBs will go under a review process and potentially be published on our website, where your work will be citable.

2. The RBB framework

Every RBB consists of two parts: a *Description*, and at least one *Implementation*. The *Description* provides the theoretical foundations and context of the RBB, and an *Implementation* describes a (context-specific) input/output, workflow and position within a particular agent-based model. All components of this framework are shown in Figure 1.

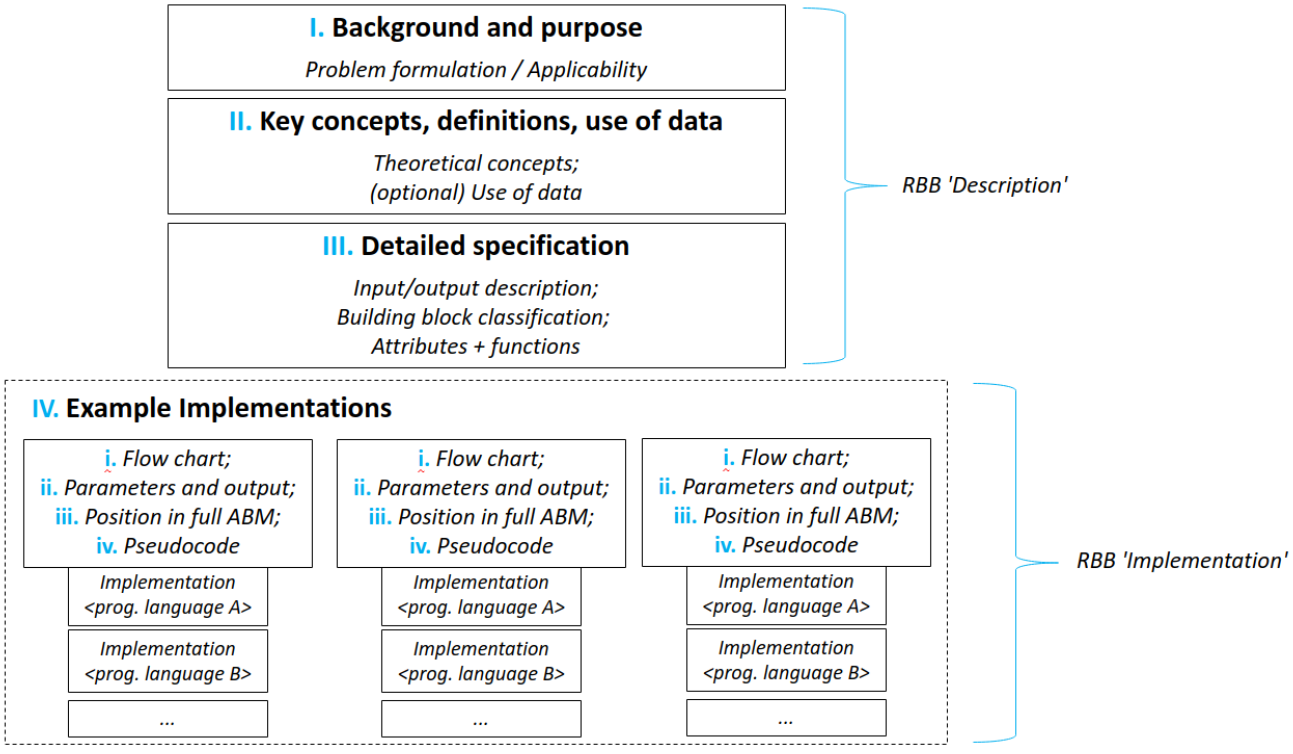

Figure 1 RBB framework

2.1. RBB *Description*

The RBB *Description* provides all theoretical background and concepts needed for a general understanding of the role of the RBB in an agent-based model. It consists of:

1) Background and purpose - here you describe the theoretical foundations on which the RBB is built. This includes its purpose (what problems does the RBB address) and the context in which it is used (when would this RBB be relevant);

2) Key concepts – explains the underlying concepts and definitions to potential users of the RBB. It provides the necessary information to gain a general understanding of the processes in the RBB. In addition, this component describes the use of empirical data in the RBB (if that applies) and the spatio-temporal scales on which the RBB is valid;

3) Detailed specification – describes the input/output and defines the agents relevant for this RBB. Please note that this concerns a general description of the input/output and agent definitions that will occur in any implementation of this RBB. Any implementation-specific parameters, agent attributes, or agent functions belong to the RBB *Implementation*.

2.2. RBB *Implementation*

In the RBB *Implementation*, you describe how the RBB is implemented in your agent-based model. The *Implementation* consists of:

1) a Flow Chart – shows the processes within your RBB. Think carefully about the scope of your RBB (which processes belong to it, which do not?), and clearly indicate how this RBB is connected to the rest of your model by including input from and output to processes outside your RBB;

2) Parameters and output – defines all input parameters needed for this specific implementation of the RBB and the output(s) it produces;

3) Position – shows how the RBB relates to the rest of your model, by means of a sequence diagram, in which the position of the RBB is indicated;

4) Pseudocode – describe the flow of your RBB *Implementation* in pseudocode. Please follow the guidelines given on the website;

5) Reusable Code Block – here you provide the actual implementation of the RBB. The code block should be a working example of the RBB in your model, meaning that all components needed to run the code should be included. While developing your RBB, think about how you can set it up in such a way that it can easily be reused by others.

6) ABM – provide a (short) description of the full model, with a link to the full model code and its documentation (this can be your report). You may provide the same link twice if you did not store these separately).

3. Submitting your RBB

3.1. Creating an account

To submit your group's RBB, you need to create an account for your group on www.agentblocks.org. You cannot work on the same RBB from multiple accounts, so we recommend creating a shared account for your group, from which you can edit and submit your RBB.

Once you have created an account and log in to the platform, you will end up on the "Help" page. The instructions here will guide you to the process of submitting your RBB: please read these instructions here carefully.

3.2. Creating your RBB

To create a new RBB, go to "RBBs" in the menu on the right and click the "Add RBB" button. From there, you can start with adding your RBB *Description*. Once you have saved a *Title* for your RBB, you can find the RBB *Implementations* in the last tab on the top.

You can edit your RBB *Description* and *Implementation* and save at any time to continue your work later.

3.3. Submitting your RBB

To submit your RBB, you must fill all required fields and check that you have provided all information by clicking the "Validate" button (both for the *Description* and for the *Implementation*). After validating, you can submit your RBB from the "RBBs" overview in the menu on the left. Please note that, once you submit your RBB, you cannot edit it anymore. Please submit only one RBB per group.

4. Support

4.1. Lecture

The tutorial on Wednesday 29.11.2023 will be dedicated to the RBB part of the assignment. Liz will be here to explain the RBB framework in more detail and give a demonstration of how to provide your RBB contributions on the website.

4.2. Technical support

If you experience any technical difficulties, cannot submit your RBB, cannot edit, or the website is not working as expected, you can send an email to Liz (e.verbeek@tudelft.nl) and explain your problem (consider adding screenshots to make your problem clear).