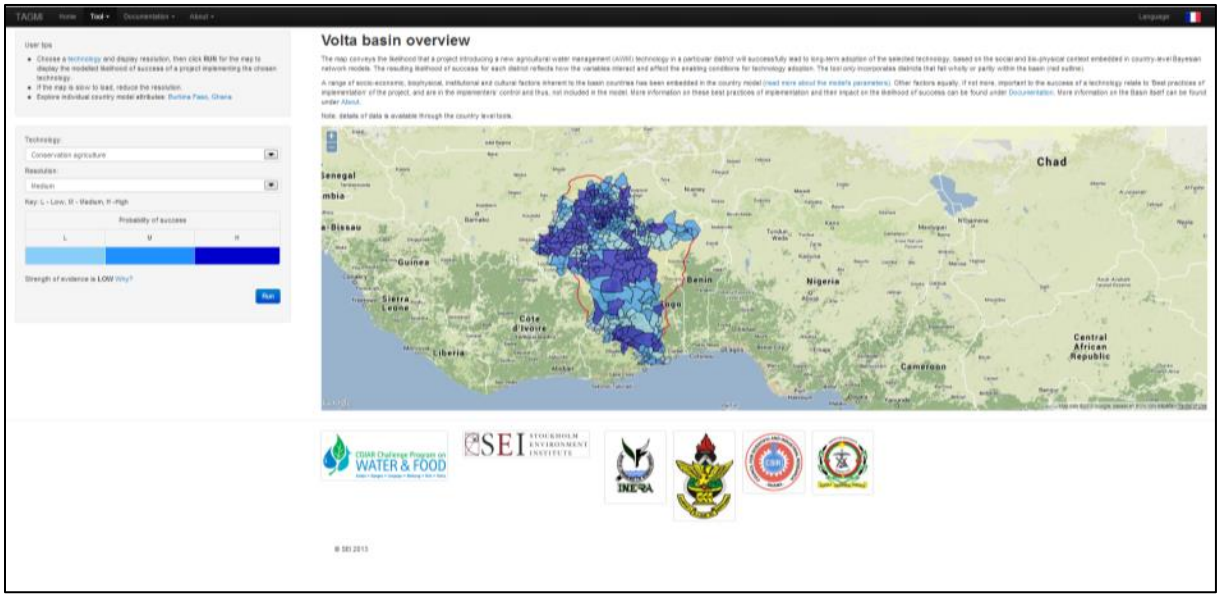
TAGMI USER GUIDE:
Targeting AGwater Management Interventions



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MOTIVATING TAGMI

Researchers, practitioners and farmers have identified approaches to manage rainfall for agriculture in efficient and productive ways from field to basin scales. Yet successful targeting and scaling out of appropriate interventions remains a challenge[1]. The targeting challenge:

- *We want to out-scale agricultural water management (AWM) technologies*
- *We want to pick sites where the chances of success are relatively good*
- *A good way to decide is through rapid assessment in the field at prospective sites*
- *But where to do the rapid assessments?*

TAGMI was designed to address this challenge as an offline and web-based "decision support" tool for targeting and scaling out of Agricultural Water Management (AWM) technological interventions in the Volta and Limpopo Basins. TAGMI conveys the likelihood that the introduction of AWM interventions for smallholder farming systems are likely to be successful at the basin, national and sub-national scales. TAGMI was built on accumulated experience and knowledge of international and nationally experts to improve on prior approaches to AWM targeting and scaling-out.

TAGMI uses a Bayes network modelling approach, which accounts for uncertainties in combining different data and information layers, and includes various sources of expertise in a spatial manner. TAGMI integrates dimensions of sustainable livelihood capital types known to be important for adoption and uptake of improved AWM strategies among smallholder farmers (DFID 1999). These innovative features and on-going consultation with end-users in development of TAGMI ensured this tool's contribution to the CPWF BDC challenges and delivers frontline research and capacity building.

Who is the tool for?

The tool is intended for non-AWM technology expert users who want to know which parts of a region have appropriate background conditions that lead to the success of a planned AWM intervention.

What can the tool do?

By incorporating existing and available data with Basin-scale coverage, the tool extrapolates where specific AWM technologies could be adopted with success based on Bayesian Belief Network modeling. Each country's TAGMI map is displaying the computed results of a Bayesian Model (see TAGMI Project Outputs for model schematics and the Bayes Model Technical Memo for more details). A model quick introduction will be included later in this document as way to understand the model customization functionality of the tool.

[1] The project seeks to answer the question of what works where and why, leading to greater impact from localised AWM success stories within the Limpopo and Volta basins. The question 'whether an intervention successfully applied in one location has a reasonable chance of success at any other location?' remains extremely difficult to answer. Numerous pilot studies and case studies have shown that detailed characteristics of the study location – economic, biophysical, institutional, and cultural – can all play an essential role in the eventual success or failure of achieving a successful outcome. However, for out-scaling of initiatives it is impractical to collect detailed information at every potential site where an agricultural land and water management (AWM) intervention might be introduced. This tool is based on the premise that, while certainty is unobtainable, degrees of certainty are both obtainable, using available information in a systematic way, and useful.

GETTING STARTED

Note: for French-speaking users in the Volta Basin, seeking a French version, click the flag in the upper right corner of the screen to switch between French and English.

Basin-Scale Models

The tool is first organized by river Basin and then by countries within the Basin. The main tool page display results at the Basin Scale for the Limpopo and the Volta. Before exploring results at the Basin scale, the user selects the AWM technology that he or she is most interested in seeing its success displayed. The table below lists the types of technology available in each Basin.

Steps:

1. Choose the basin, then
2. Choose the **technology**
3. Choose the display **resolution**
4. Click Run

Technology: A wide variety of AWM technologies were discussed throughout the project[2]. The resulting model and tool includes technologies grouped by three main categories meant to cover the spectrum from community-level technology to more individual farm-level technologies. Many contextual factors that lead to the success of the tools included in TAGMI e.g. biophysical features of a given area, may be similarly important for other AWM technologies. As such, the included technologies and suggest how the model result would be applicable for similar technologies:

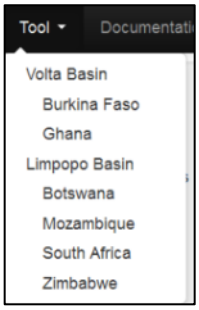
TAGMI Technology Choice	Definition and Applicability to Similar Technologies
VOLTA BASIN	
Soil and Water Conservation	Represents in-situ soil and water management practices, including mulching, bunds, planting pits, windbreak hedging etc.; applicable to Conservation Agriculture
Small-scale Irrigation	Represents groundwater use technologies like the use of shallow and deep wells
Small reservoirs	Represents water storage technologies from which farmers may choose to irrigate (including market gardening)

[2] An initial listing of successfully and relevant technologies was developed in 2011 with Basin partners and experts. The second round of Learning Events enabled small working groups to offer input on what factors matter for certain technologies to be successful in Fall of 2012.

TAGMI Technology Choice	Definition and Applicability to Similar Technologies
LIMPOPO BASIN	
Conservation Agriculture	Represents in-situ soil and water management practices, including mulching, bunding, planting pits, minimum-tillage etc.; applicable to Soil and Water Conservation technologies
Small-scale Irrigation	Represents small-scale irrigation technologies, including drip irrigation
Small reservoirs	Represents rainwater water storage technologies from which farmers may choose to irrigate

Resolution: Given the various bandwidth capacities of our end-users, the tool is available in low, medium, and high resolution. The higher resolution has the finest map detail and the low, the inverse. Note that the results themselves do not change, depending on the resolution, only the level of detail in the GIS layer's detail e.g. district outline.

Country-Scale Models



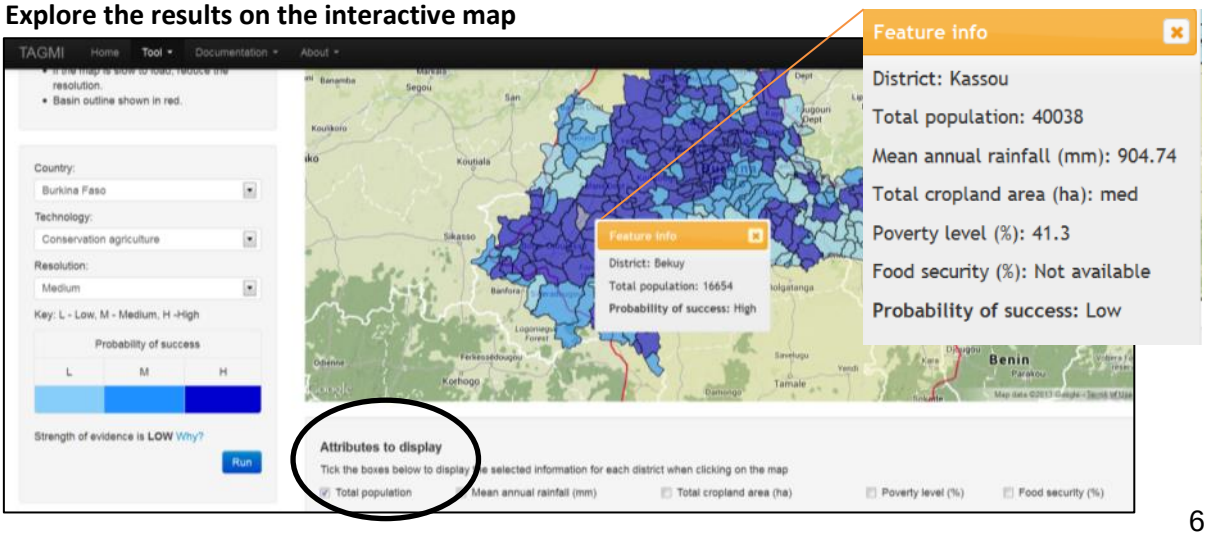
For those interested in results at the country and sub-national levels, navigate to the country-specific models. Links for which, are available through each Basin page.

Steps:

1. **Choose the basin, then**
2. Choose the country
3. Choose the technology
4. Choose the display resolution
5. Click Run
6. Click on a district to view "feature info"
7. Choose different "Attributes to Display"

Note- once you have selected additional attributes, you need to close and re-open the Feature Info boxes to change what's shown

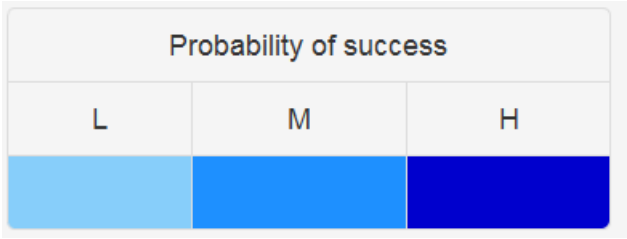
8. **Explore the results on the interactive map**



Interpreting Results: Understanding the Probability of Success

'Success' is conditional on adequate levels of 5 **capitals**: Human, Social, Financial, Physical and Natural. Water resources are included as a separate 6th capital given its centrality to AWM (**Error! Reference ource not found.**). Capital definitions are taken from DFID (1999), and included below. Factor and data layer definitions and calculations are detailed in the Metadata documentation.

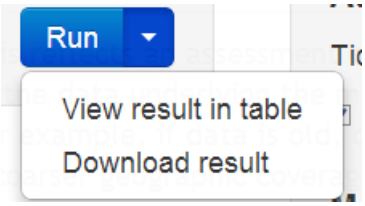
CAPITAL	DEFINITION
NATURAL CAPITAL	stocks from which resource flows and services (e.g. nutrient cycling, erosion protection) useful for livelihoods are derived
WATER RESOURCES	Characteristics of water resources that describe availability, access and quality of the water
HUMAN CAPITAL	the skills, knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives
SOCIAL CAPITAL	the social resources upon which people draw in pursuit of their livelihood objectives; typically described in terms of networks and connectedness, membership of more formalised groups and relationships of trust, reciprocity and exchange
FINANCIAL CAPITAL	the financial resources that people use to achieve their livelihood objectives
PHYSICAL CAPITAL	basic infrastructure and producer goods needed to support livelihoods

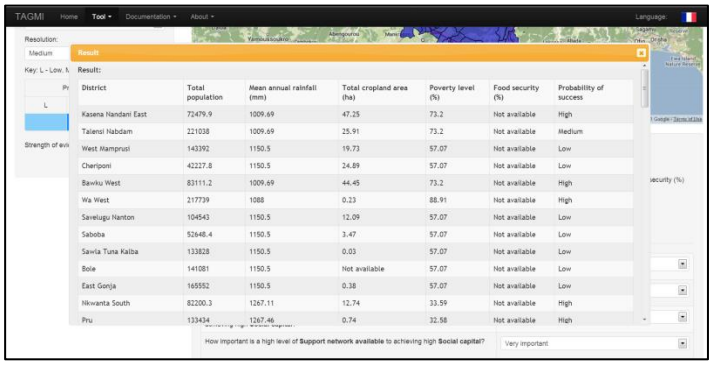


The map conveys the Probability of Success at the sub-national, district-level based on the Bayesian model's computations of the Context Factors which include district-specific characteristics, as well as characteristics of the technology. The end results (Low - Medium - High) indicates the probability that an AWM project implemented in that district will be successful. The result is formed by the interaction of varying levels of the important influencing factors (e.g. rainfall, land, labour, infrastructure or skills). For example, if all important factors are present at high levels, the probability of success will be High. If all important factors are low the probability of success will be low. If some are high and some are low, then the result depends on how relatively influential each factor is, and how they interact with each other; this is where the need for the model becomes apparent.

- If a districts is shaded **LIGHT BLUE**, implementing a project there will be likely to succeed, and could potentially lead to out-scaling.
- If a districts is shaded **BLUE**, implementing a project there will be less likely to succeed than those that are **DARK BLUE** but have a higher likelihood of success than those that are **LIGHT BLUE.**
- If a districted is shaded **DARK BLUE**, implementing a project there will be less likely to succeed; the various factors present a less conducive to a successful outcome.

Downloading Tabular Results





Once TAGMI has been **RUN** for a selected Country and Technology, the model's resulting assessment of the Probability of Success can be both viewed as a table in the user interface (image above), or downloaded as a .csv file-readable in softwares like Microsoft Excel. The attributes that are displayed by District, which inform the model's Factor values, are also included in these tables.

How do I find out more?

- Try another technology to see if it is better-suited to a particular district
- More information about the model, basins, and technologies is found at About and Documentation
- Explore the **Model Customization**
- options in the next section of this User Guide

Model Disclaimer

There are some considerations and caveats for using the outputs of the tool:

- The necessary data are incomplete and imperfect such that the tool's prediction will be associated with a level of uncertainty depending on input data quality, which reflected in the Strength of Evidence statement in the legend[3]:
- No model can *fully* capture all the complexities of agricultural communities and their environments

MODEL CUSTOMIZATION

TAGMI's results are influenced by four aspects of the Bayesian model:

i) The data itself (quality and availability)

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[3] **Strength of Evidence:** Bayesian models do not need all of the evidence needs to be present for every variable. In instances where data is missing for one or several different locations, it is important to signal that the value for the probability of success is less certain than in for other locations with complete data. The model measures the change in the model outcome from a null state (no evidence) to an informed stated (with evidence). The result of the calculation informs the 'strength of evidence' that is displayed in the tool. This is a measure of the quality of the data used, as well as the amount of missing data.

- **LOW**: data is old, or available at a coarser geographic coverage or scale of analysis than the model is at (district-level), the evidence base for the result is weak, and the strength of evidence will be LOW. Can also reflect an uncertainty in how well the data used is related to the concept it describes.
- **HIGH**: data is recent, consistently representative across the country, at district level and highly relevant for all factors in the model, the evidence base for the result is strong and the strength of evidence will be HIGH.

ii) The importance of the **data**[4] (designated by experts or the model designer)

iii) The importance of the **factors** (designated by experts)

iv) The importance of the **capitals** (designated by the model designer, based on input from experts)

The specifics of (i – iv) are detailed in the *Technical Information Brief: TAGMI Bayes Network Model*; however, we define Factors and Capitals briefly as they relate to the interactive model customization.

- A **Factor** is "a circumstance, fact, or influence that contributes to a result1" in this case the result is the successful implementation of an AWM technology. Thus, why we refer to them as Factors of Success. Factors affecting success are both those related to the "Context" (outside of the implementer's control) and those related to "Best Practice" (inside the implementor's control). Only "Context" factors are modeled.
- A **Context Factor** is a characteristic of a project site that was present before the project started and is outside the control of the project (e.g. biophysical characteristics - rainfall, institutional characteristics - government policies, socio-economic characteristics - income, skills, health).
- The model further groups Context Factors into five categories of '**capitals'** or 'assets' using the DFID Sustainable Livelihoods Framework (DFID, 1999; Scoones, 1998).

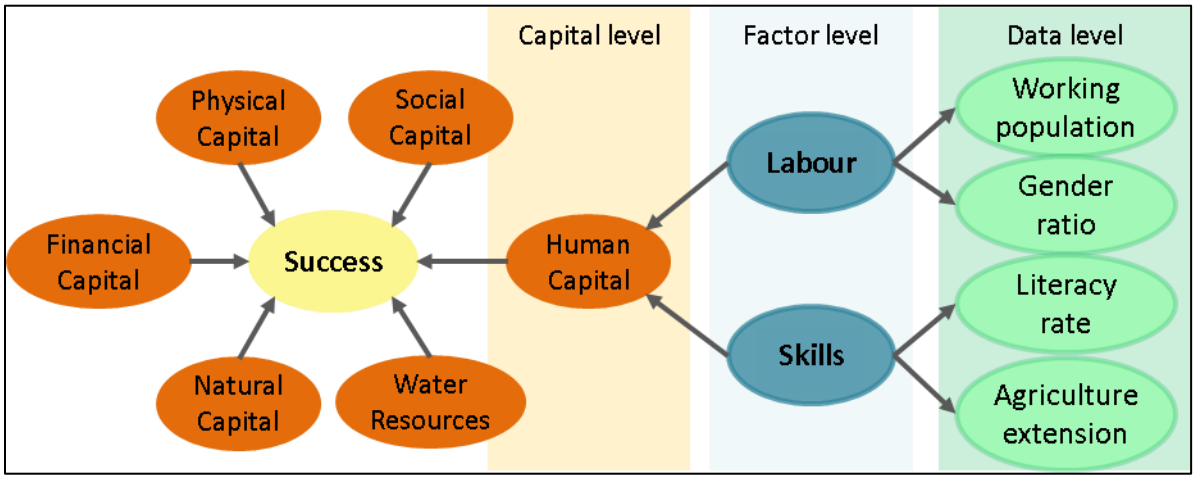

Figure 1. Schematic of the Bayes Network model components that inform TAGMI's results.

As you see in the screen shots that follow- TAGMI enables the user to customize the importance of the two main model components– **Capital** and **Factor** – the user can assign their own weighting to reflect their assessment of a component's importance. It's useful to look at the entire Bayes Network Image, as exemplified in the figure below, in order to better visualize how the factor and capital variables are then grouped by capital.

[4] The **data** variables indicates the presence or level of a factor, and in this case they act as proxy variables to convey the presence of given factor of success. These have a number, or quantity that increases or decreases over time the data supporting each Indicator has been documented to provide a sense of the representativeness of the maps displayed.

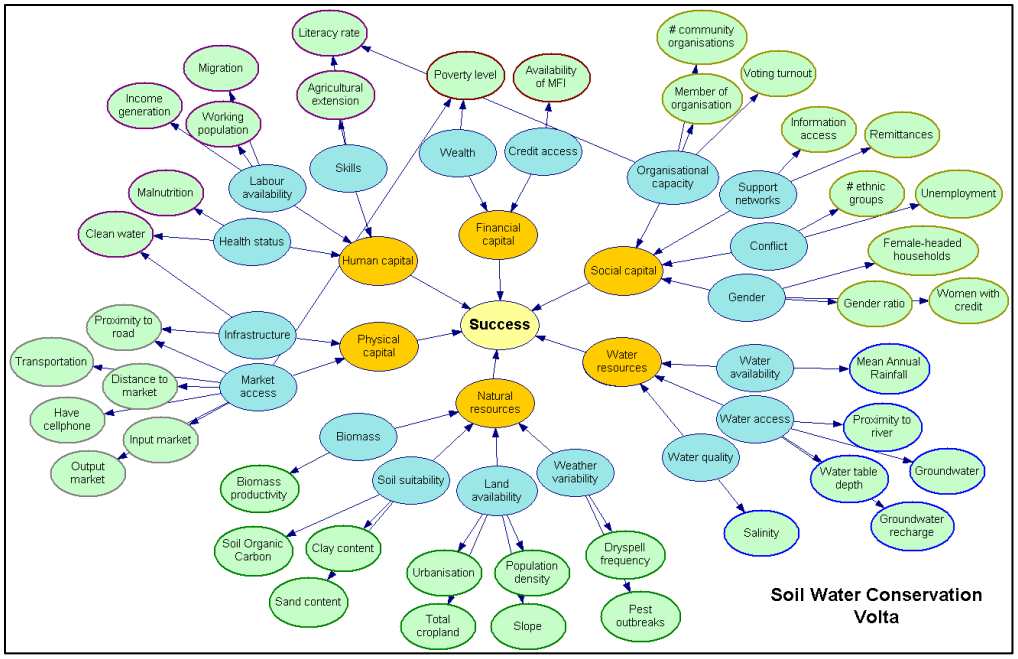

Figure 2. Bayes Network Image for one AWM technology in the Volta Basin: Soil Water Conservation

Basic Functions

- Unless the tick box under model customisation is checked, the changes you make will not be applied.
- Once you are satisfied with the changes you have made- be sure to click Run in the Legend Area.
- To reset the model to its initial set up click *Reset to Default Setting* and Run, or simply deslect the customization checkbox.

Capitals

The aim here, is to think about the selected AWM technology and using your prior knowledge and awareness of successful and failed interventions, assign a level of importance that weights each capital with respect to success- note, this does not mean ranking capitals against each other, they can have similar levels of importance with respect to success e.g. the default model assigns the importance of the 6 capitals as either very or extremely necessary based on the input and feedback received throughout the course of developing TAGMI.

Based on the input received, we've found that all capitals are important to some degree for an AWM intervention to be successful. It could be that for certain technologies, like those that are more individualized, human and/or financial capital may be more important than social, while the farmer's social capital, that is, his connectedness to other farmers or institutions, is still important just to a lesser degree. For example, he or she can still install a drip irrigition system successfully on their farm with sufficient financial resources and technological "know-how" without interacting with neighbors etc.. On the other hand, had they been socially connected and talked to neighbors that were early adopters of a technology, they may have been further motivated try a new technology given its proof of acknowledged success on a nearby farm.

Now explore how assigning different levels of importance to the capitals affect the probability of success:

1. Select **COUNTRY** and **TECHNOLOGY** and click **RUN:** What is the overall probability of success?
2. Tick **model customisation,** look at the **Capital tab**:
3. Change all capitals to **important**, click **RUN** Is the probability of success **LOW** or **HIGH?** Why?
4. Change all capitals to **essential**, click **RUN:** Is the probability of success **LOW** or **HIGH?** Why?
5. Change all but one capitals to **important** but of your choice to **essential**, click **RUN**
6. What is the current importance of each capital? Change the level of imporance by capital, according to your expert opinion.

Interpretation and Weighting Guidance:

- When **all** capitals are **important**, the probability of success is **HIGH** because the AWM intervention will be successful independent of level of a given capital.
- When capitals are **essential**, the lack of any given capital, given how vital they are to success, acts as a barrier to success. When all capitals are **essential,** anything less than a high level of capital(s) leads to a probability of success is **LOW**.
- When some capitals are more essential than others, the probability of success is **LOW – MEDIUM – HIGH –** depending on the combined interactions and status of the data and factors within the model.

Factors

Factors contribute to the probability that given capital is high or low. Their level of contribution varies according to the weighting either assigned, as in the model 'default settings', or by the user using the Factor Tab in the Model customization menu.

Interpretation and Weighting Guidance:

- A factor with a high weighting (**Very Important** or **Essential**) will have a greater impact on the capital than one with a low weighting i.e. induce greater change towards achieving the capital.
- If all factors contributing to one capital have the same weighting, they contribute equally to the probability of achieving a higher level of that capital.
- By weighting a factor as **Not Important** or **Somewhat Important**, then there will be little modeled change in the capital.

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