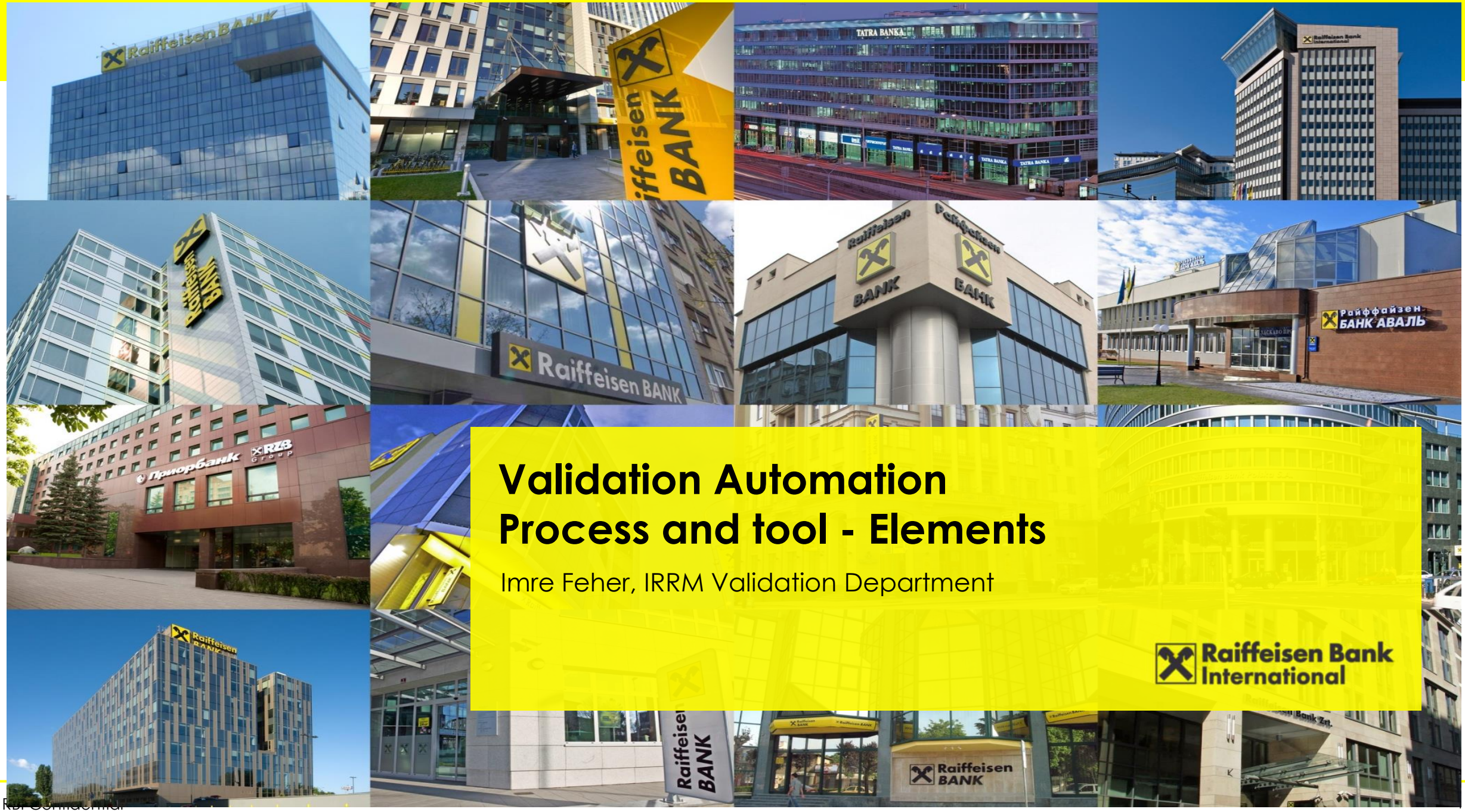
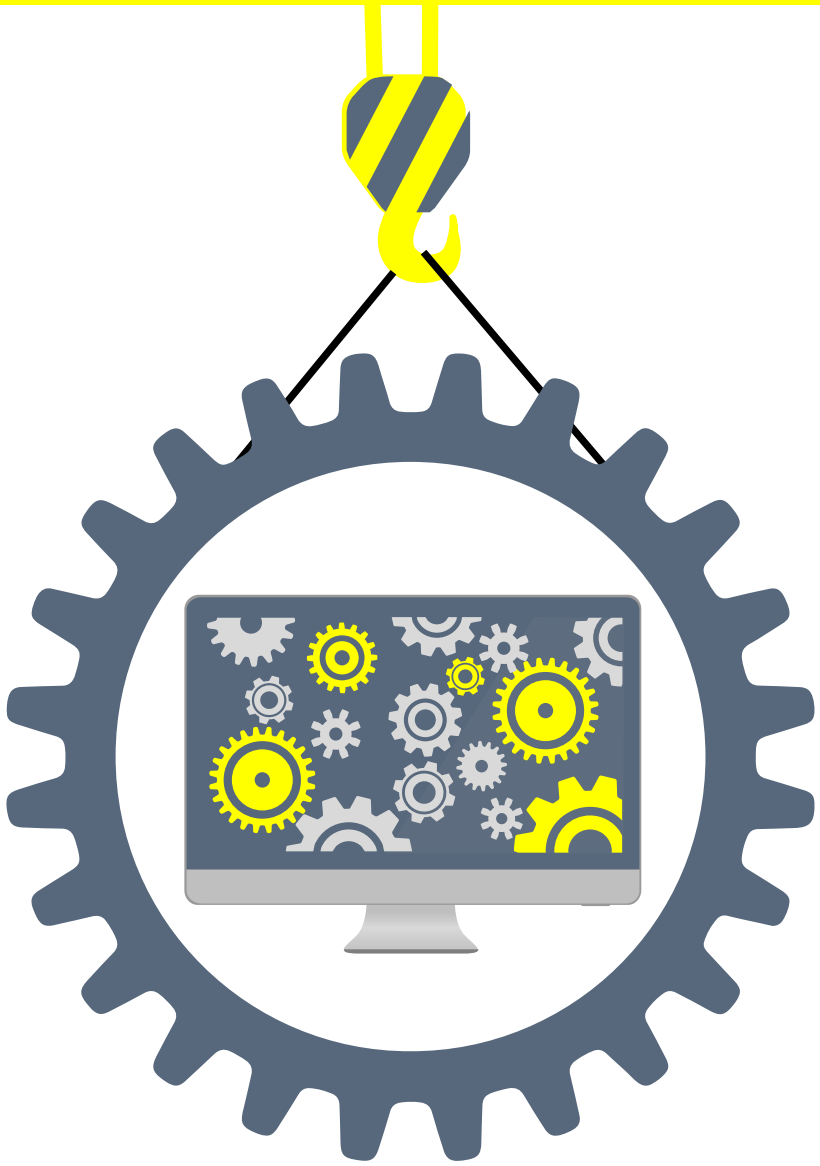


Validation Automation Process and tool - Elements

Imre Feher, IRRM Validation Department

Raiffeisen Bank International

Agenda



01 Project Based Approach

02 Collaboration workflow

03 New open source tools

04 Dynamic outputs

Project Based Approach

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Collaboration workflow

- Each periodic review is a separate project
- Collaboration framework
- Iterative process
- Parallel review and validation documentation

Data and code close together

- Standardized data requirements
- Standard file structures including data and code
- Standard model types, each model represents a separate component
- Code templates and output templates

New open source tools

- R and RStudio IDE
- Version control (Git)
- Standardized tables and diagrams
- Markdown markup languages to produce dynamic documents

Dynamic Outputs

- Reproduceable documents and validation assessment
- Automatic rerun (makefile)
- Notebooks for condition deep dives and condition closing

Collaborative validation process

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Step 1

Validation Kick-off

- Validation owner and local reviewer set up the project environment as an RStudio Project

Step 2

Local reviewer

- Defines list of models under review
- Loads up the raw data.
- Runs DQI scripts
- Runs R Scripts to prepare standard output (table, chart)

Step 3

Validation Owner

- Review DQI report
- Runs R Scripts to prepare standard assessment
- Discuss results with LR

Step 3

Collaborative documentation

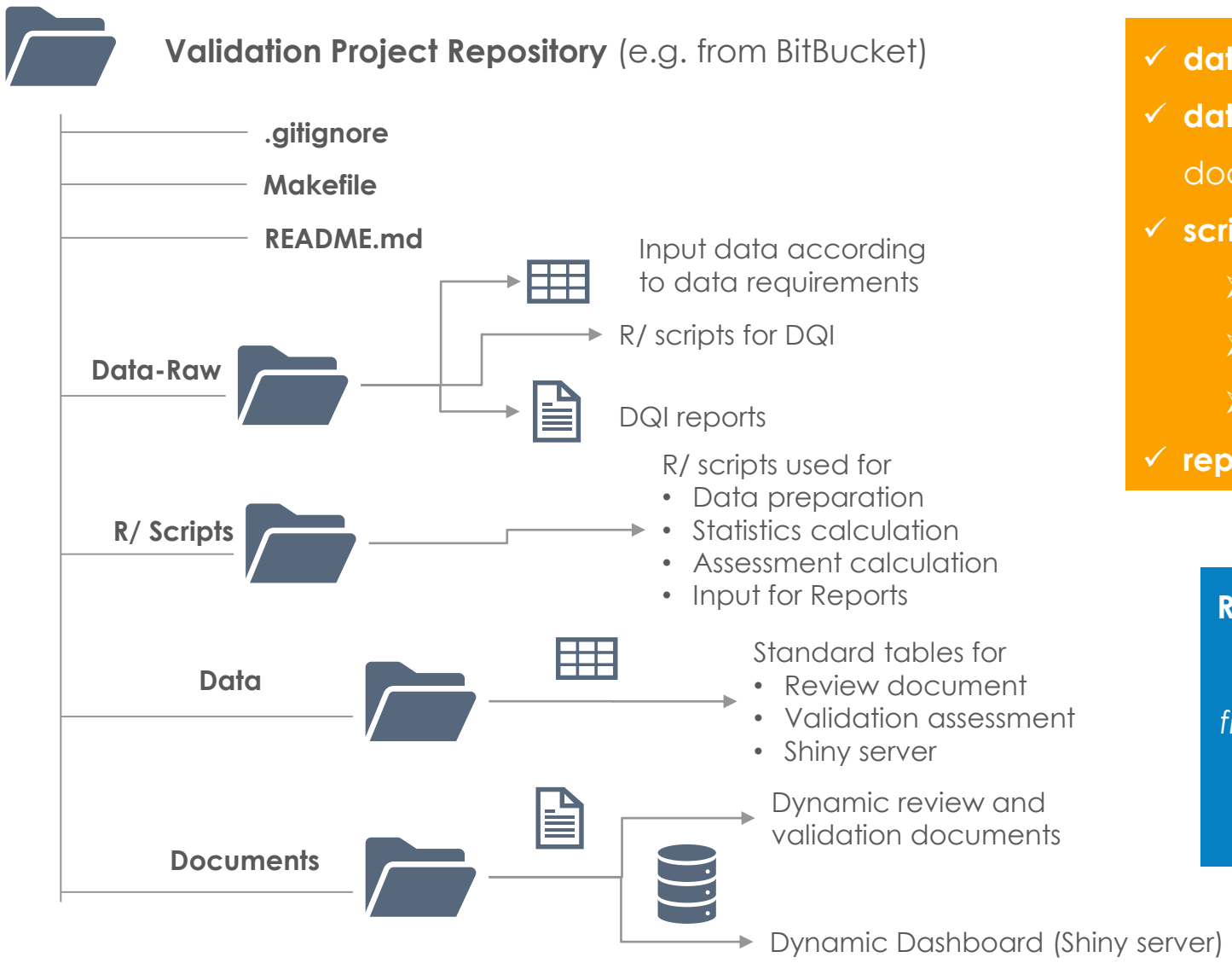
- Reviewer prepares review documentation
- Validation owner prepares validation report

Step 4

Follow up

- Condition closing in the project
- Archaization of the project in MGS

Data and code close together



- ✓ **data-raw**: according to data requirements
- ✓ **data**: R tables produced by the R scripts for documentation (tables, diagrams etc.)
- ✓ **scripts includes**:
  - ➢ Scripts to produce tables
  - ➢ Calculation of statistics and assessment
  - ➢ Dynamic document markdown scripts
- ✓ **reports**: findings to present to others

Reproduceable validation:

"the data and code used to make validation findings are available and they are sufficient for an independent reviewer to recreate the validation process" – after Peng (2011)

Tools of reproducible validation

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R Language and RStudio IDE

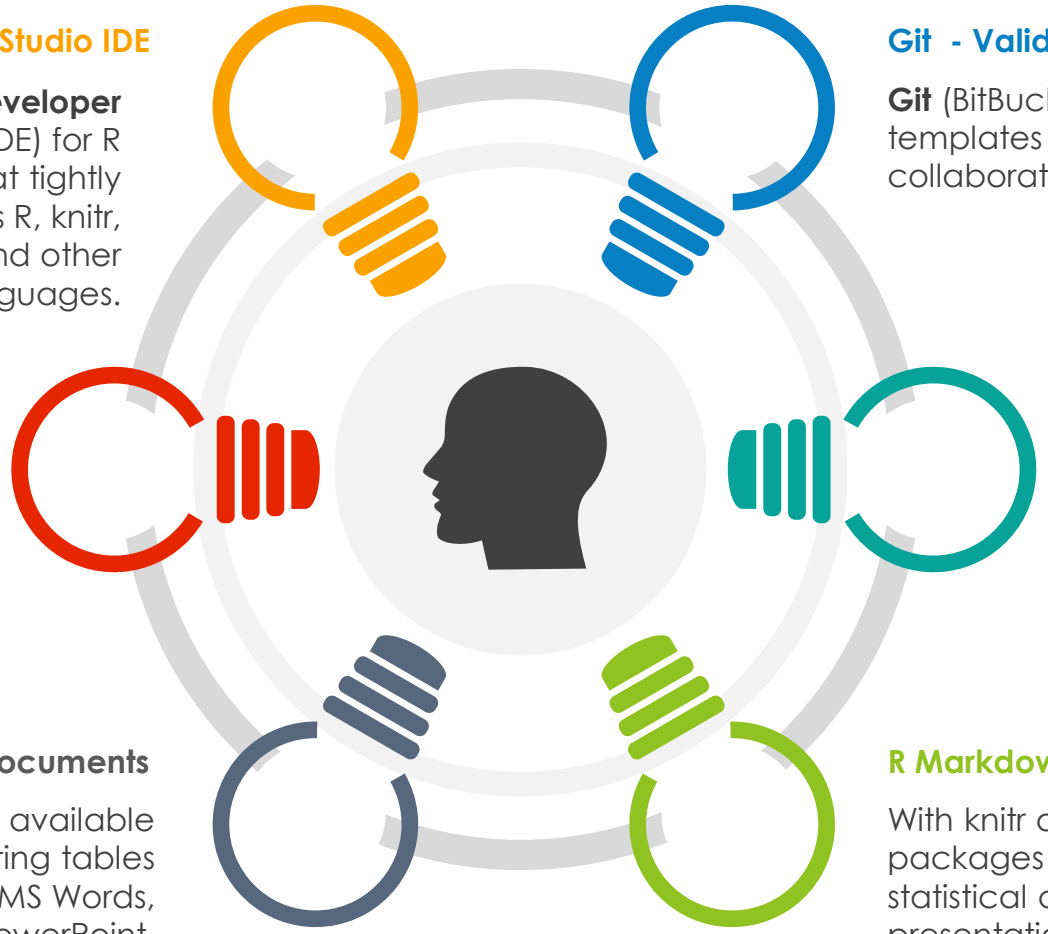
Integrated developer environment (IDE) for R projects that tightly combines R, knitr, rmarkdown, and other markup languages.

Shiny Server

Dynamic web application for and **interactive dashboard** and documents online

Export to MS Office Documents

Flexible R packages available for exporting tables diagrams to MS Words, Excel, PowerPoint.



Git - Validation version control

Git (BitBucket) for storing initial templates and document collaboration

Tidyverse Package

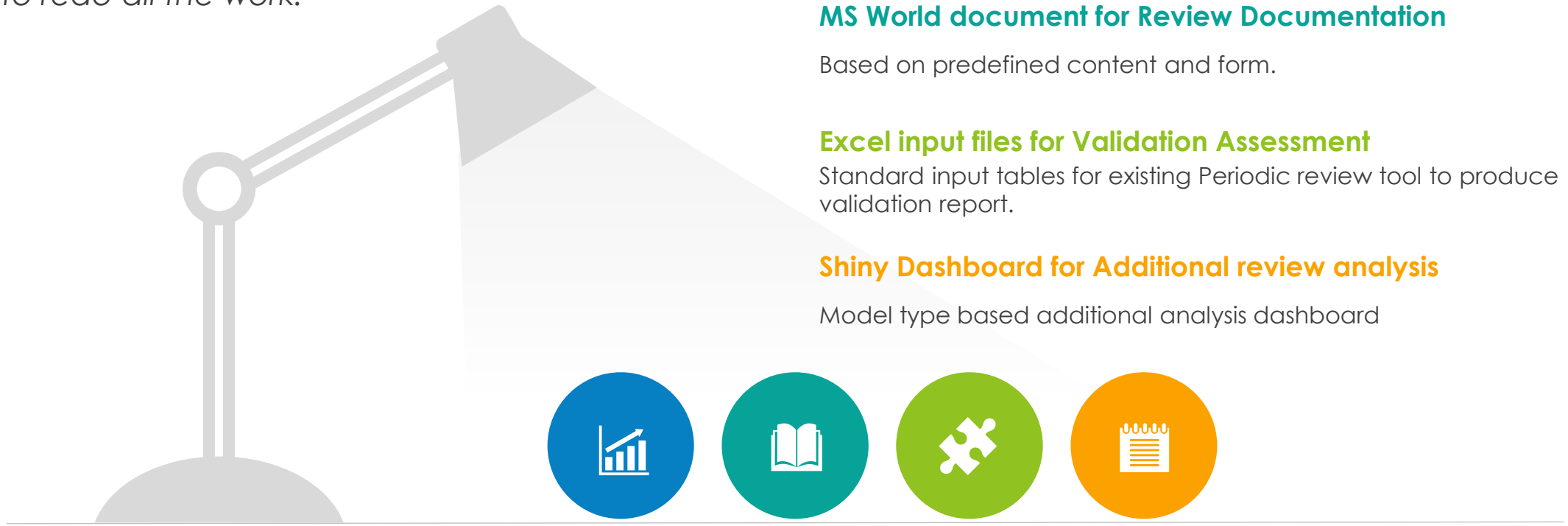
The tidyverse is an opinionated **collection of R packages** designed for data science. All packages share an underlying design philosophy, grammar, and data structures.

R Markdown templates:

With knitr and rmarkdown packages one can combine statistical analysis and the presentation of results

Easily reproduceable documents

*"**Make** figures out automatically which files it needs to update, based on which source files have changed. … As a result, if you change a few source files and then run Make, it does not need to redo all the work."*



DQI reports on validation sample and raw data inputs

Standard Report Data Quality Impovements

MS World document for Review Documentation

Based on predefined content and form.

Excel input files for Validation Assessment

Standard input tables for existing Periodic review tool to produce validation report.

Shiny Dashboard for Additional review analysis

Model type based additional analysis dashboard

Thank You