



EMMC Translators Guide

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Sources

- ❑ EMMC-CSA workshop in Vienna, April 2017
- ❑ EMMC-CSA Expert meeting on Translation, June 2017, Eindhoven
- ❑ Translator Case and Industrial User Case Surveys, April-August 2017
- ❑ Translation cases
- ❑ Translators Charter
- ❑ EMMC Road Map

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- ❑ EMMC-CSA Translators Team: Pietro Asinari, Natalia Konchakova, Luca Bergamasco, Gerhard Goldbeck, Daniel Hoeche, Georg Schmitz
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Translators Guide

❑ Background:

Need of Translators to exchange their best and worse practices in translation:

- Identify steps of the translation process
- Identify the best scenarios for implementation of modelling workflows
- learn from the worst practices

❑ Goal:

The Guide for Translators will describe the methodology and the possible scenarios for the translation, including a strategy for the training of industrial operators.

This guide will be instrumental in building awareness and confidence in applying modelling for a broader adoption, in particular by small medium enterprises (SMEs).





Translators Guide: content

- Translation process and steps**
- Translation for SMEs**
- Translation for large companies**
- Internal and external translation**
- General consideration/guidelines**
- Translation cases**
- Training for translators**
- Tasks of the Translator**
- Profile of the Translator**





Generic/universal Translation steps

1) Good understanding of the business case

2) Good understanding of the industrial case

3) Analysis of the experimental (and modelling) data available within the client:

4) Translation to (preferably more than one) modelling workflows

5) Propose to the client modelling executor(s) and strategy for model validation

6) Translation of the modelling results to information that is understandable, reliable and usable by the client





Generic/universal Translation steps

1) Good understanding of the business case:

- *Impact (e.g. profit, jobs, ...)*
- *Risks*
- *Timeline of the client*
- *Expected by the client outcomes (soft and hard)*

2) Good understanding of the industrial case:

- *Where and what exactly is the problem: material or processing related or other*
- *Factors that have an effect e.g. technical specifications.*

3) Analysis of the experimental data available within the client:

- *This data is needed for model input and validation.*
- *The quality and accuracy/uncertainty of this data must be well understood.*
- *If needed, the Translator can propose “dedicated experiments”*





Generic/universal Translation steps

- 4) Translation to (preferably more than one) modelling workflows, considering:**

 - *Availability of the models/software tools, their suitability, efficiency, performance and level of maturity (user friendliness, especially for SMEs), model accuracy/predictability, client's experience*
 - *Costs: investments in person months and hardware, simulation time*
 - *Return of investment / benefit*
 - *Validation of the model: strategy for validation of each modelling flow, considering the available experimental data and generation of new data*
- 5) Propose to the client modelling executor(s) and strategy for model validation**

 - *Based on executor's expertise, experience, availability and client's preference (if any)*
 - *Follow the project execution and represents the client interests*
- 6) Translation of the modelling results to information that is understandable, reliable and usable by the client**

 - *A follow-up, evaluation of the process, interpretation and recommendations are desirable but not always required*



Translation process: what can help?

- Have realizable plans
- Have a proper language to address the client (SMEs) : neither too technical nor too basic
- Estimate the costs of the project and of the translation activity
- Become acquainted with the client facilities, e.g. production lines
- Make correct interpretation/utilization of the model and analysis of the results
- Have databases of software, models and modellers, training activities/events
- Have combination of skills in modelling, domain-applications, soft skills, industry, economics (see further Code of Conduct)
- Have regular translation activities to gain experience
- Modelling marketplace: a list of translators that can be contacted, specified by domain or by model expertise
- Promoting the Translation role on EU and national levels





Translation for SMEs

- ❑ “Universal” translation process: independent on the size of the industrial client but allowing for flexibility
- ❑ Do SMEs need translation more than large companies?
- ❑ Translation challenges related to SMEs:
 - The people in SMEs usually have hands full with their normal daily work and have little time for research (also true for companies of all sizes)
 - SMEs are generally less organized for R&D and require more complete support
 - SMEs cannot take risks related to present modelling capabilities
 - SMEs problem tend to be more specific
 - SMEs do not have the required expertise
 - It is not always possible for SMEs to take very challenging projects
 - SMEs usually cannot afford it: financially and commercially not possible/feasible
 - Clarify whether translators should help SMEs to model themselves and to sell them the software or sell them the pure translation service





Translation for SMEs: challenges and translation actions

- ❑ The correlation to their **business cases** is not clear
- ❑ Lack of **examples** on successful use of modelling

Action: Have in hand successful stories on real industrial problems and business cases on the benefit of modelling, explaining well what are the limitations and capabilities of modelling. Translators can propose/organise no-risk "tester" sessions where a problem related to the problem of the SME is discussed & partially solved

- ❑ The total **cost** of ownership is too high as SMEs usually don't have big research budget
- ❑ Huge investment for **infrequent use**

Action: Provide (rough) investment vs return analysis and adjust the modelling flow and executors (the modelling project budget) to the budget available in SMEs

- ❑ SMEs cannot afford to fail so they are less likely to use technology that they are **not familiar** with
- ❑ **Scepticism** on the ability of models to actually provide useful answers..
- ❑ The **plethora of models** available is confusing for newcomers

Action: Explain/convince in understandable for the SMEs way the benefits and economic impact from modelling application for their business cases. Build trust at first contact.





Translation for SMEs: challenges and translation actions

- ❑ Lack of **modelling engineers at SMEs** (possibility for collaboratively paid researchers?)
- ❑ Lack of basic **knowledge** of physics and chemistry in the SMEs

Action: Talk the language of SMEs and provide/suggest training opportunities, including training for academic/open source codes which are more affordable (with good documentation), training for novel models as well as training for the commercial software.

- ❑ **High overheads, narrow expertise** and **little mathematics** in academia

Action: Engage in educational activities targeting more applied and broader academic modelling expertise

- ❑ Dependence on **bigger companies**

Action: Try to involve SMEs in joined projects with large companies

- ❑ Different time-expectations between academia and industry

Action: Understand well the business/industrial case and agree on the expected time-frame of the modelling project. Select accordingly models and executors that align with this time line.





Translation for SMEs: generic translator's actions

Coordination and networking:

- Present/post success stories at **platforms** where the SMEs gather (exhibitions, internet platforms, social media)
- Create **clusters of SMEs** that can share modelling tools/projects/experience
- Invite SMEs to **workshops** focused on modelling/simulation applications to real problems that they can relate to. Focus on the benefits of modelling and not on technical details
- Publish **easy to understand articles on modelling in popular for the SMEs journals**

Collaboration:

- Support **collaboratively paid licenses** for expensive software or licences bought by academia
- Facilitate **collaboration of SMEs with software companies**
- Create a **network between Academics and SMEs** to optimize the needs.
- Lobbying:** on EU and national/regional level for funding modeling projects with SMEs; promote tailoring of materials to components as key factor for innovation/profit.





Translation for big companies Internal and External Translation

Internal and external translation

- Internal translation: translation performed by employees of industrial end user for their own company (or/and for company's clients)
- External translation: translation performed by external (independent on the client) translator





Benefits and drawback of internal translation

Benefits of internal translation:

- Short times of the translation and implementation of modelling results/ solutions due to better knowledge/understanding of the client's (own company) industrial and business cases and the economic impact of modelling
- Allows for a close interaction with customers. Having the knowledge in-house is added value on top of the product that is sold, connecting customers to the company
- Allows a company to connect to research institutes and universities closely, which is beneficial for advancing the institutes and attracting young people for jobs in the company.
- Higher motivation and drive for successful translation and its outcome
- Allows for better overview of new industrial topics or strategic changes
- The trust of the client is already gained which makes the translation more powerful and efficient (e.g. in acquiring cooperation from client's management)
- Can propose more independently the suitable modelling executors (unless those are available in-house which often are then preferred)

Drawbacks of internal translation:

- A company needs to be of a critical size in order to have the necessary translator's skills/expertise in-house.
- Expensive and large staff needed. Training curve is steep





Benefits and drawback of external translation

Benefits of external translation:

- It is a more popular type of translation with more extensive practice. This can contribute to a wider and updated knowledge on the available modelling tools and possible alternative approaches
- Large number of external translators available
- External translators have wider network of modelling experts and other translators
- Can offer deep expertise in a business areas that are currently unexplored by the client

Drawbacks of external translation:

- More scepticism from the industrial client (at least in the beginning)
- Confidentiality agreements need to be put in place (concern for data and information security)
- More difficult or takes longer to understand well the industrial and the business case
- More difficult to estimate the investment and return (benefits/economic impact)
- Administration and costs may be (too) high
- Difficult to stay independent from its own institution policy/loyalty for modelling execution choices, unless the external translator is independent (consultancy-type) translator
- Implementation of the outcome from the modelling project may be less straightforward: often it is required by the external translators to translate also of the outcome of the modelling to understandable/usable by the client results/deliverables





Industrial view on materials modelling

- ❑ The companies expect from the materials modelling:
 - Measurable business benefits
 - Good and tailored (specified and quantified) accuracy
 - To be application-oriented (not only material oriented)
 - Improved predictability, validation, time efficiency and focus on solving specific industrial problem rather than to providing general trend or variety of possibilities
 - Combination of physics-based and data-based models
 - Fast (even if less accurate) solutions

- ❑ Hindering factors for modelling implementation in industry.
 - The costs of modelling: relatively large investment (which needs to be quantified) vs. often unknown return on investment.
 - The long simulation time
 - The often unclear reliability of modelling
 - The lack of understanding from the modellers on the business benefits of modelling for the industry





Industrial view on materials modelling

- ❑ Modelling as a tool for BDSS
 - Typical questions related to BDSS are related to accuracy, reliability, costs and time of using modelling, as well as number of experiments avoided due to modeling.
 - The reliability of available data is often difficult to be assessed. However only reliable data with reliable models can be used for business decisions.
 - The large number of data from simulations requires efficient data processing into simple meta models, including data extrapolation and interpolation.
 - It is relevant to know what are the expectations of different stakeholders in a company with respect to using material modelling as supporting tool for BDSS.
 - The modelling data needs to be presented in understandable (e.g. excel-type) format in order to be useful for business decisions.

Feedback obtained from Vienna's workshop

- ❑ *To take full advantage of modelling and BDSS integration, two-directional, autonomous communication between them could be provided?*
- ❑ *Do we need to specify further BDSS and the role of modelling?*





Economic impact of modelling

- ❑ Measurable business benefits:
 - ✓ Number of modelling re-use
 - ✓ Number and saved costs from avoided experiments
 - ✓ Saved cost from avoided use of expensive/dangerous materials
 - ✓ Comparisons of some parameters, e.g. time to market or number of product/production failures before and after the use of modelling
 - ✓ Direct profit/revenue
 - ✓ Higher margins from the new solutions provided by modelling
 - ✓ Added product value by Digital products documentation
 - ✓ Other KPIs – report from EMMC is coming soon!

Collaborations between the client and translator's experience in evaluation of the economic impact!





Ideas how to facilitate modelling implementation

Feedback from Vienna's workshop

- ❑ To develop and distribute documentation or even standardized tools for calculating financial metrics (e.g. return on investment) related to the implementation of materials modelling that could be available on the EMMC website.
- ❑ To determine what quantitative indicators/ economic impacts are important, keeping in mind that the answer varies across various materials modelling stakeholders.
- ❑ To find ways for encouraging users to estimate these quantitative indicators and to share their quantitative results in an effort to communicate the benefits of materials modelling so that large scale adoptions takes place

Actions coming up from EMMC-CSA (WP4 & WP6)





Translation cases

- ❑ From the Translator Case Survey:
specific translation cases from different type Translators - Research Institutes
and Consultancy organizations, SWOs
- ❑ Limited number of translation cases are provided from Software Owners
/Engineers and independent consultants
- ❑ Missing are difficult (unsuccessful) translation cases...
- ❑ The Guide will contain some example of a Translation cases

Actions:

- *Collect Translation Cases from SWOs and independent translators*
- *Collect Translation cases for different industrial sectors: discuss sector-specific Translation methodologies (if such are needed)*





Training for Translators

- Training on estimation of the economic impact of modelling, e.g. what is the risk if modelling is not performed. How deep should we go?
- Training on estimation of the investment vs. benefit (ROI): is this needed only for the translators?
- Training guidelines/advice given by Translators to industrial researchers /engineers
- Training events: on schedule starting from 2018 (information will be placed on <https://emmc.info/>)





Ideas about how to promote translation further

- ❑ ***European recognition of the role of translation***

- ❑ ***Tools for promoting translation further***
 - Benchmarks
 - Virtual screening for perspective returns
 - Academic/industrial collaboration programs
 - Specific workshops with successful case studies
 - Seminars and webinars

- ❑ ***Synergy between European and national actions for promoting translation further***
 - European projects for industrial development
 - Creation of an exchange platform
 - The actions should be uniformed at European and national level

- ❑ Any other ideas are welcome!





Translators Tasks and Profile

- Tasks (role) of the Translator: what is expected from the Translator
- Translators profile: which skills should a Translator possess





Tasks of the Translators

- Find the best expert, suitable code, optimal solution
- Balance between investments and expected return
- Neutrality. Third parties might be involved in the implementation
- Getting the required input of data from the industrial stakeholder
- Managing data confidentiality
- Managing change at the industrial stakeholder :e.g.
 - Readiness to learn to simulate
 - Hiring and integrating new skills
 - Learn to manage a subcontractor for simulation

Presented by Gerhard Goldbeck, ENF2017, Malta





Profile of the Translator

- Industrial background**
- Academic/technical background**
- Deep and broad knowledge of modelling and software tools**, including the limitations and pitfalls of the tools and methods.
- Broad understanding of different experimental techniques and data analysis**
- Softs skills**
- Knowledge of economic impact**
- Being neutral**
- Expected to show a proven “track record” of expertise on translation**, including success stories.





Profile of the Translator: Industrial background

- ❑ The Translator works on the **interface between business and R&D** during all stages of the development (design, testing, up-scaling, market introduction).
- ❑ Translators should **focus on the industrial problem**. Before any possible modelling workflows or simulation cases are proposed, a full understanding of the problem and its industrial context is necessary.
- ❑ Translators **support the implementation and utilization of modelling** and simulation by enhancing the skills of the industrial operators. This is best accomplished by adapted training efforts.





Profile of the Translator: Knowledge of modelling

- ❑ **Knowledge in the use of the four different materials models** (electronic, atomistic, mesoscopic and continuum) and their linking/coupling
- ❑ **Deep and broad knowledge of modelling and software tools**, including the limitations and pitfalls of the tools and methods and where the required tools can be found (where is the modelling expertise)
- ❑ **Knowledge of the expected accuracy and limitations of modelling:**
need to have toolbox (e.g. LCA tools, data repositories, etc.) to be able to evaluate the applicability/accuracy/predictability of certain models and to compare different models (in qualitative or semi-quantitative way)

EMMC Survey coming soon for academic modellers, software owners/engineers and industrial users of modelling!





Profile of the Translator: Data analysis and Experiments

Knowledge of different experimental techniques and data analysis

- Modelling requires input of data from the industrial stakeholder. The **quality of the input data** needs to be in accordance with the proposed workflow/simulation case and this is to be addressed by the Translator.
- If available data is limited the Translator can propose “dedicated experiments”.
- Expertise for results interpretation in the industrial context
- Confidentiality issues of industrial data are a key point.





Profile of the Translator: Economic aspects

- Technical and economic aspects are both important in business decisions. Therefore the Translators can make use of the results and the tools developed through the integration of materials modelling in the BDSS to balance them.
- Translators will help to make the balance between investments (resources and expertise) and expected return.
- Translators need a broad economic background to advice on costs and time to solution.
- Translators take into account the human factors: skills, readiness, management of subcontractors etc.
- Chose the modelling workflow that has the best compromise between reality description, expected calculation time and available material properties

Tools to make ROI evaluations are largely missing: courses /training for Translators on this topic are needed!





Economic aspects: Estimation of the benefits of modelling

Qualitative benefits

- ❑ Deeper understanding
 - To avoid upscaling issues and lower risk of market introduction
 - To make better informed decisions about material, product and processing choices
 - To support trouble-shooting and avoid dead-ends
- ❑ R&D strategy development, e.g. via early exploration of behaviour in downstream applications
- ❑ Avoiding potentially hazardous experimentation
- ❑ Lower cost to obtain certain property data (e.g. due to cost of experiment/synthesis)
- ❑ Estimate property data for materials that cannot be obtained for competitive reasons
- ❑ Avoid destructive testing.
- ❑ Faster optimisation/identification of materials, formulations, processes and designs
- ❑ Improve value chain interactions
 - Validation of supplier information
 - Build customer trust
 - Demonstrate competitive advantage via competitor materials based on models
 - New types of business: from Product to Product +

Source: "Materials Modelling KPIs" written by Gerhard Goldbeck, full text soon on the EMMC website!





Economic aspects: Estimation of the benefits of modelling

Quantitative benefits

Simple quantitative indicators

- Number of Models in use in the R&D organisation
 - For Physics Based models: number of validated/tested Materials Relations
- Cost saving
- Number of innovations (product, process, business) achieved
- Jobs created

Return on investment (ROI)

Simplest measure that can be applied is:

$$\text{ROI} = \frac{\text{Revenue generated from a project involving modelling}}{\text{Investment in materials modelling for the project (people, software, hardware)}}$$

Source: "Materials Modelling KPIs" written by Gerhard Goldbeck, full text soon on the EMMC website!





Profile of the Translator: Soft skills

- Excellent communication skills
 - Speak the academic and the industrial language
- Convincing
- Good listener
- Asking the right questions
- Ability to extract the necessary information from the customers
- Analytical mind setting
- Flexible
- Trustworthy
- Diplomacy
- Salesmanship





Profile of the Translator: Neutrality

- The Translator is expected to give neutral advice and third parties might be involved in the implementation of the modelling workflow
- Translators should be free from hidden self-interests. Must place the interest of the clients before the interests of the Translator.
- More than one solution should be proposed to the client to choose from.
- A proposed solution for the industrial problem should not be biased towards the Translators favourite models, methods or software tools.
- Translators may be part of the team providing a solution, if this is for the best interest of the client.
- Translators can be expected to show a proven track record of expertise in modelling, if they are part of the modelling execution.





Neutrality: some considerations...

- ❑ Consider section "**Conflicts of Interests**": how to deal/balance between own (translator's) interest and client's interest.
- ❑ Should there be some "**Surveillance of the money flow**" and possibly a limit to how much of the project budget initiated through a Translator goes to his/her own organisation, or not?
 - *YES: There should be restrictions for the budget flowing to the Translator's own organization to ensure that neutrality is preserved and that translation is distinguished from project acquisition.*
 - *NO: There should not be restrictions in budget flowing to the Translator own organisation. It should be even tolerated if people executing the Translator role are also part of the modelling execution as this will facilitates/speed up the whole project.*
- ❑ If we are not able to find a new innovative ways for doing Translation, and fall back to the standard procedures implemented in our own institutes, we do not strive for innovative ways to bring modelling to industry by starting from and focusing on industrial challenges.





Profile of the Translator: Track record

- ❑ Translators can be expected to show a **proven “track record”** of expertise on translation including success stories.
 - *Sharing success stories and translation projects **could be restricted by confidentiality.***
 - *Successful translation stories **do not need necessarily to be also related to successful modelling cases.** They should demonstrate the usefulness of the translation process itself, independent on the modelling execution process which may depend on many other factors not necessarily related to the translation process. Technical details (and names/topics) could be avoided if confidentiality is an issue.*
 - *The “track record” of the translators can be used by the client and **stored/published in the EMMC database of translators.** The latter is useful for SMEs searching for translators to help them implement modelling.*

- ❑ **Translator’s work on domestic level.** The SMEs often prefer to talk rather with a domestic Translator in their own language. Therefore it is important to build local Translators network in each country.





Translators for SMEs and for Large companies

- ❑ Some **differences in the characteristics of the Translators** for SME and Large Companies
 - SMEs usually need a more integrated problem solving approach which includes non-modelling issues: they require from the Translator a rather broad knowledge/expertise and soft skills
 - Large companies often have modelling expert in-house and can require from the Translators more specific modelling expertise (in a certain domain/model) that is missing internally
 - SMEs and large companies have different timeframes for investments: SMEs are faster (need to be faster) in taking decisions and require from Translators flexibility and quick(er) solutions

- ❑ The Translator is not an individual person but a role which is usually best fulfilled by **a team of people** with skills required for the efficient execution of the translation process.

- ❑ The Translator role may differ in terms of required skills, depending on the specific case/client.





Actions

Translators:

- ❑ EMMC Survey for model developers, software owners/engineers and industrial users of modelling to define the criteria that translators can use when selecting the most suitable model/software
 - **Model developers (modellers)** are expected/encouraged to provide:
 - Model validation cases/procedures
 - Accuracy (when possible to be evaluated)
 - Model specifics e.g. level of model maturity/development: new models (higher risk models) vs. more mature models (expected to have also more established validation/benchmarking procedures)
 - **Software owners/engineers** are expected/encouraged to provide:
 - Relevant (validation) case studies to demonstrate the accuracy of their software (such can often be found also in software manual)
 - Applicability and especially the limitation of each software
 - Upon specific request: round-robin tests by software users and model developers or additional demonstrations for specific industrial case
 - Link to the Survey will be placed on <https://emmc.info/> with invitation to the modeling community to participate.

If SWOs and Modellers can't/don't provide the information needed by the Translators, their models/software may not be used/preferred by Translators





Actions

Translators:

- Organize training sessions/workshops on estimation of the economic impact of modelling (investments and benefits)

Modellers and SWOs:

- Provide data base of models and software classified by type, material, property. For each of these indicate range of accuracy, simulation time, hardware facility needed, limitations. Possible issues with confidential data!

Other...?

