TRANSLATORS GUIDE

1. Background and Goal of the Translators Guide

The Translators Guide is instrumental in building awareness and confidence in applying modelling for a broader adoption, in particular by small medium enterprises (SMEs). It is a tool that can be used not only by Translators but also by industrial users of modelling, specifically to know what to expect from Translators and from the process itself.

The goal of the Translators Guide is to help translators when approaching industry, when defining/choosing the right modeling workflow and when defining the benefits of the modeling project. It gives directions on possible ways to execute transition. It is up to the Translator to decide/choose how to accommodate the guidelines described in this document. The choice depends, for example, on the type of industry and on the level of modelling required.

The Translators Guide describes the methodology and the possible scenarios for the translation, for large companies and for SMEs. In the Translators Guide specific examples of best and worst Translation cases are not included. Successful and difficult translation cases will appear separately on the EMMC website and in the Translators Database within the Market Place.

The Translator Guide can be considered as living document and it can me further modified if such modification is needed/requested.

2. Translators Guide

2.1 Translation process and steps

2.1.1 Generic/universal Translation Steps

These steps indicate how the translation proceeds. The sequence of execution of the steps is not fixed but it depends on the specific case. Iterations of some translation steps may also be required.
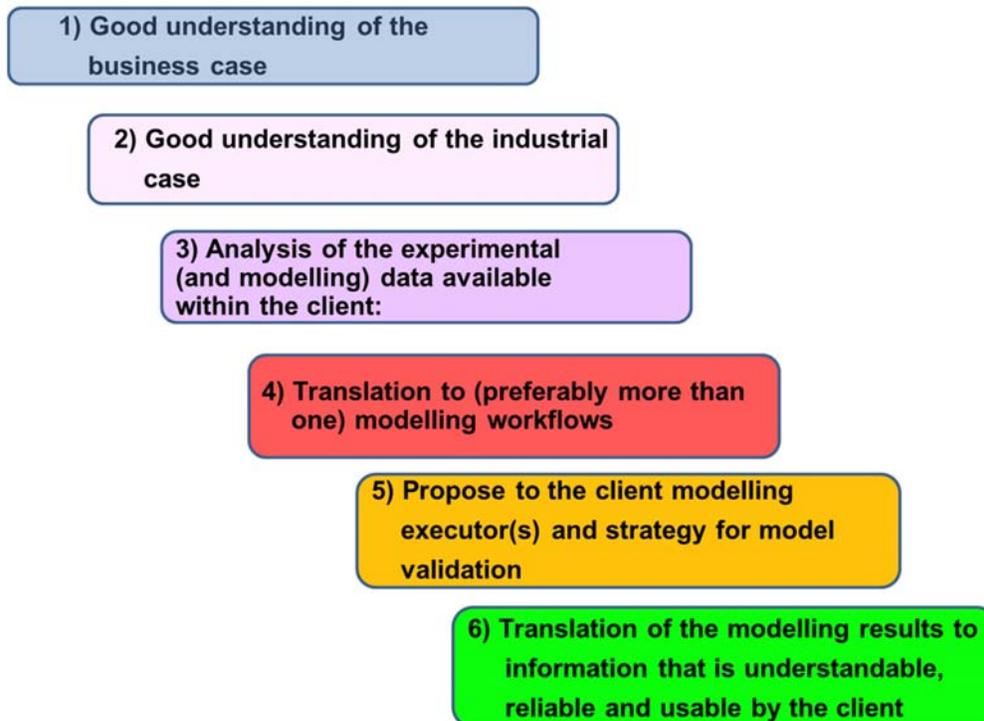

Figure 1 – The different steps of the Translation process.

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)
   - ❑ What does the client means as success

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 (and modelling) 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".

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 moths 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 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

2.1.2 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 Profile of Translator)
❑ 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
❑ Have the right person to talk to in the company (as first contact): for SMEs should be somebody on executive level, for large companies it should be an R&D type manager.
❑ Learn from SWOs: translation can be approximated with the software development line.

2.2 Translation for SMEs

The translation process can be considered as "universal" and independent on the size of the industrial client but it should take into account the specific needs of the client, being an SME or a large enterprise. This section discuss the translation process for SMEs.

Considerations regarding 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

2.2.1   SMEs challenges and possible translation actions

- ❑ Currently, the correlation of modelling to the business cases of SMEs is not clear
- ❑ Currently, there is a 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. Attention: the tester sessions may not always be easily funded by SWOs. Translators can look for (co-)funding by national/regional governmental initiatives.

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

Action: Provide (rough) investment vs return analysis and adjust the modelling flow and executors (the modelling project budget) to the budget available in SMEs. Look for additional (co-)funding by local/national initiatives/funding bodies.

- ❑ 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.

- ❑ 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. Discuss possibility for collaboratively paid researchers/modellers.

❑ Academia often has high overheads, narrow expertise and little mathematics teaching

Action: Engage in educational activities targeting more applied and broader academic modelling expertise. This can facilitate not only SMEs but also large companies.

❑ SMEs dependence on bigger companies

Action: Try to involve SMEs in joined projects with large companies and take care that SMEs interests and benefits from the projects are clearly taken into account. Attention that EU projects might be too long for SMEs.

❑ 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.

2.2.2 Generic Translator's actions for SMEs:

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
- ❑ Support/initiate a study on what type of specific/fragmented market sectors SMEs are interested in, as generic software is usually too broad for SMEs specific problems.
- ❑ 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.

2.3 Translation for large companies: internal and external translation

Large companies can have sufficient modeling expertise and experts to be able to perform translation by themselves, for their own company as client (or possibly for companies partners). In this case we talk about **internal translation**. When the company makes use of external (independent on the client) experts as translators, the translation process is named here **external translation**, which is currently the common/dominant type of translation. Below the characteristics of internal and external translation for large enterprises is discussed.

2.3.1. Internal Translation

Benefits:

❑ 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:

❑ 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.

2.3.2. External translation

Benefits:

❑ 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:

❑ 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

2.4   General considerations/guidelines

2.4.1   Current industrial view on materials modelling

This part briefly discuss the generic view of industry on the potential, the use and the hindering factors of modelling for solving industrial challenges and as a supportive tool in business decisions.

Expectations of the companies 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

Modelling as a tool for Business Decision Support Systems (BDSS)

A separate document has been prepared by EMMC-CSA (D6.2) that deals with the requirements of industry for integration of material modelling in their business decisions. Below is a summary of some of the issues related to this topic.

❑ 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

❑ To take full advantage of modelling and BDSS integration, two-directional, autonomous communication between them could be provided.

2.4.2   Economic impact of modelling

The implementation of modelling in BDSS requires also estimation of the economic impact of modelling. This estimation is of huge importance also for Translators to convince/demonstrate to industry the potential and the benefits of modelling. The economic impact of modelling is best to be estimated by the translators and the client together. Below are listed some of the measurable and qualitative benefits that can be used for this estimation.

A separate document has been prepared by EMMC-CSA, with guidelines for estimation of the KPI related to modelling. The document will be available on the EMMC website.

Measurable (quantitative) business benefits of modelling:
- ❑ Number of modelling re-use
- ❑ Number of models in use in the R&D organisation. For Physics Based models: number of validated/tested Materials Relations
- ❑ 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
- ❑ Number of innovations (product, process, business) achieved
- ❑ Jobs created

Qualitative benefits of modelling
- ❑ Deeper understanding
  - o To avoid upscaling issues and lower risk of market introduction
  - o To make better informed decisions about material, product and processing choices
  - o 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
  - o Validation of supplier information
  - o Build customer trust
  - o Demonstrate competitive advantage via competitor materials based on models
  - o New types of business: from Product to Product +

Ideas how to facilitate estimation of the economic impact of materials modelling
- ❑ 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

Return on investment (ROI) : simplest measure that can be applied is:

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

Help/training of Translators is needed for setting the right assumptions that need to be taken intoc account for the ROI estimation.

2.5   Translation cases

Various Translation cases has been collected. Some are (and will appear) on the EMMC website and all cases will be listed in the Translators Database within the Market Place.

More Translation Cases need to be collected, from different type of Translators. These cases will be used by Translators to demonstrate the translation process – its benefits and successes but also its bottlenecks, to learn from. A translation template can be helpful in documenting and in collecting the Translation Cases. Efforts need to be put in collecting translation cases also for different types of industry (SMEs and large companies) and for different industrial application sectors.

2.6   Training for Translators

Several training activities for Translators have been identified, as listed below. EMMC-CSA is currently prepare a plan for training of Translators which will be distributed and posted on the EMMC website (before end of 2017).

❑ Training on estimation of the economic impact of modelling, e.g. what is the risk if modelling is <u>not</u> performed. Open question: how detailed should be this estimation?

❑ Training on estimation of the investment vs. benefit (ROI). Such training will be offered also to the model developers/software engineers.

❑ Training guidelines/advice from Translators to industrial researchers /engineers

2.7. 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

2.7   Translator tasks and profile

This part of the Guide contains description of the tasks and the skills of the Translators, previously considered as Translators Code of Conduct.

2.7.1   Translator tasks

❑ Find the best expert, suitable code, optimal solution

❑ Balance between investments and expected return

❑ Neutrality/credibility: provide to the client arguments/justification on the choice of certain modelling tool and executor as being most suitable for the client's problem. Third parties might be involved in the implementation.

❑ Getting the required input of data from the industrial stakeholder. Data hygiene.

❑ 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

2.7.2   Translator profile

Translator is not an individual person but is 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. The skills required for the Translator role are discussed below in more detail.

2.7.2.1 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.

2.7.2.2 Deep and broad knowledge of the modelling and the software tools, including their limitations and pitfalls and knowledge on where the modelling executors/expertise are.

❑ 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: Translators 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).

2.7.2.3 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 evaluated by Translators (data hygiene) at the beginning of the process. The Translator then proposes a workflow/simulation case that can best fit/make use of this specific data and for which validation data can be available.

❑ 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.

❑ Have experience in working with experimentalists. If they have not worked with modellers this could be a challenging task.

2.7.2.4 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

2.7.2.5 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

2.7.2.6 Neutrality/credibility of Translators

- ❑ The Translator is expected to give neutral and justified advice on the choice of the proposed modelling tool(s) and executor(s) as being most suitable for the client's problem. Third parties might be involved in the implementation of the modelling workflow. Credibility can also be shown via non-confidential translation cases ("proven track record").
- ❑ 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 can be proposed to the client to choose from (e.g. if the client has modelling expertise to be able to make the choice, if the client self asks for several workflows, or if more than one solutions are possible/available/suitable for the specific problem)
- ❑ A proposed solution for the industrial problem should not by biased towards the Translator's 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.
- ❑ It may help dealing with neutrality if there is a template illustrating the selection of specific modelling workflow/solution. Such template could request to give answer to some questions, for example "what is currently available as tools/models for this specific problem (state of the art)", "who is providing such tools/models", "what is the level of development of the tools/models", "what is their accuracy, costs, time for simulation" etc.
- ❑ Industrial users of modelling should be educated to ask from the Translators for good argumentation on the choice of specific modelling tool for solving their problem (e.g. what are the advantages of this tool over other, are there alternatives, which groups that are using this tool are most experienced or most nearby etc.)

2.7.2.7 Track record

- ❑ Translators can be expected to show a proven "track record" of expertise on translation including non-confidential 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. Translators would hesitate less to publish unsuccessful cases if publication could be done anonymously.
  - ➤ 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.

2.7.3   Translators for SMEs and for Large Companies

The translation process and the skills of the Translators working for large companies and for SMEs may differ because:

❑ 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

❑ 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.

❑ 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. For SMEs the project are usually short-term, while for large companies also long-term projects are interesting.

2.8   Necessary actions

<u>For Translators:</u>

❑ Prepare and use a template to document and to collect Translation Cases

❑ Issue an 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:
  o Model validation cases/procedures
  o Accuracy (when possible to be evaluated)
  o 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:
  o Relevant (validation) case studies to demonstrate the accuracy of their software (such cannot be easily found in software manual)
  o Applicability and especially the limitation of each software
  o 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

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

<u>For Modellers and SWOs:</u>

❑ 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.

3. References

The Translator Guide was created based on the feedback from several EMMC events, meetings, discussions, surveys and other documents, as listed below.

- ❑ 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
- ❑ EC workshop on Translation, 21 September 2017, Brussels
- ❑ Translation cases
- ❑ Translators Charter
- ❑ EMMC Road Map

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