CONTROL IN STEEL

Deliverable 2.4:

Report on transferability

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1. Aim of the this deliverable

ControlInSteel is a dissemination project reviewing 46 conducted research projects of the RFCS. This report summarizes the analysis results with respect to transferability.

2. Transferability Index

2.1. Definition of the transferability index

In order to find a common way which helps to analyse and compare transferability among the reviewed projects, it is important to introduce a suited metrics. The ControlInSteel team uses the following scale definition throughout the subsequent analysis:

- 0 – no transferability can be expected, not transfer has been reported
- 1 – same aggregate, same plant direct transfer was possible
- 2 – same aggregate, different plant transfer
- 3 – different aggregate, same plant transfer
- 4 – different aggregate, different plant
- 5 – different Industry, similar aggregate
- 6 – different Industry, diverse aggregates

We call this scale the **transferability index**. This approach is like studies in other fields, that compared different research approaches. Yet, we apply here an integer index concept with very distinct levels. An example is e.g. the work of Antonanza et al. [1], who consider a completely different context and use a floating point index value.

2.2. Channel of transfer

The projects feature typically different aggregates, methods and solutions. All of these aspects can be potentially used for transferring the results. We define these ways of transfer as so-called **transfer channels**.

Nevertheless, it is typically one of these aspects that unfolds the most potential for further adoption in industy. As stated in 2.1, results could remain in the same plant but be transferred to another (similar or same) aggregate or otherwise spread widely among other plants. For our analysis we identify the **primary channel of transferability**, that is the **result aspect of the project with the highest transfer potential**.

2.3. Recipe to retrieve the transferability index and primary channel from project reports

Although one way to retrieve transferability of a project is direct communication with the project coordinators, the most reliable source of information about the transferability of a projects results is to base it on the publicly available final reports.

During its assessment, the ControlInSteel team performed the following survey for analysing the transferability:

1. Review of the "Comparison of initially planned activities and work accomplished" sections for a broad overview of the project (information which is also used for the analysis of barriers and issues)
2. Review of the "Exploitation and impact of the research results"
3. Review of potential "Transferability" sections
4. Review of the involved methodology (sensorial infrastructure or solution in general) answering the question: "Was the project a substantial driver to promote or demonstrate the advantages of a method?"

2.4. Examples of how the index and the channel are extracted

The diversity of analysing transferability becomes clearer when considering the following examples:

a) Project GlobalShapeControl considered very specific modelling at the rolling mill to predict shape parameters of strips. Its primary channel is the aggregate rolling mill, as the considered shape aspects are very specific to the process of rolling. In its runtime and based on assessing the report, the transferability index is 1, where the transfer was really constraint to same aggregates at the same plant.

b) The project SoftDetect investigated ways to measure quality and process parameters at different types of rolling mills. It focused on soft-sensors as technical solutions that proved to be highly adaptable for this purpose. Their primary channel of transfer is therefore the concept of soft-sensor and this was successfully transferred, not only to similar aggregates during project runtime, but also to different plants and completely different types of processes (furnaces and logistics…). Its transferability index is 4 and its primary transfer channel the soft-sensor.

c) The project MicroControl considered ways to determine the microstructural characteristics. They applied laser ultrasonic sensors for their measurement and established a series of important successes for this technology. LUS have a tremendous transfer potential, are the primary transfer channel of MicroControl and lead to an transfer index of 6.

2.5. Specificities when analysing the projects

The actual aspect of transferability was considered with increased interest over time, indicating a shift in the interest of reviewers and stakeholders as well. While older projects did not address this aspect in their report explicitly, most modern works discussed the implications of transfer including the corresponding constraints to it and the value it could generate. Roughly since 2008, transferability became an important cornerstone for achieving impact.

3. Bibliography

[1] Antonanzas F, Rodríguez-Ibeas R, Juárez C, Hutter F, Lorente R, Pinillos M. Transferability indices for health economic evaluations: methods and applications. Health Econ. 2009 Jun;18(6):629-43. doi: 10.1002/hec.1397. PMID: 18677724.

Table 1. Transferability analysis.

	Primary Transfer Channel	Transferability Index	0	1	2	3	4	5	6
CEFLA	Rolling mill	1							
7210-PR/338	Rolling mill	1							
7210-PR/339	Rolling mill	1							
7215-PP/076	Rolling mill	1							
CASTDESMON	Caster	2							
IPCDS	Rolling mill monitoring system	2							
SHAPEHPM	Rolling mill	1							
AUTOCHECK	Zinc layer thickness control	4							
S5	Strip shape monitoring	2							
GLOBALSHAPECONTROL	Rolling mill	1							
SOFTDETECT	Soft sensor	4							
IMGALVA	Galvanisation	2							
SensoCont	Pickling line operation software	4							
Smartfire	Furnace	3							
FinalPlateFlatness	Rolling mill	2							
Awicco	Rolling mill	1							
HIGHPICK	Pickling line	2							
Linecop	Galvanisation	2							
Edgecontrol	Rolling mill	3							
SensorControlPilot	Pickling line	3							
Deffree	Continuous Caster	2							
SISCON	Surface Defect Parsing	2							
Fosucor	Rolling mill	2							
MICROCONTROL	Laser ultrasonic sensor	6							
Flexpromus	Acid analysis technique	4							
Cognitive Control	Control Techniques	5							
OPTISHAMP	Shapemeter	2							

Table 2. Transferability analysis continued.

	Primary Transfer Channel	Transferability Index	0	1	2	3	4	5	6
ICONTENS	Residual Stress Predictor	4							
TECPLAN	Production Planning System	4							
DYNAMO	Furnace Simulation	2							
ICONSYS	Modular Service Concept	5							
I2MSteel	Reallocation Software	5							
PUC	Microstructure Analysis	2							
SOPROD	Model-based Self-Optimization	4							
DYNERGYSteel	Software for Energy Management	4							
MICROCONTROL-PLUS	LUS	5							
INFOMAP	Shape control	2							
ORSC	Control Technique	4							
GASNET	Gasnet Optimiser Software	5							
AUTOADAPT	Adaptive Control Techniques	4							
Cyber-POS	Digital Twin System	4							
MACO PILOT	Acid Concentration Managment	5							
SUPPORT-CAST	Continuous Caster	2							
FlexGap	Adaptive Roll Bearings	2							
NEWTECH4STEEEL	Big Data Technologies	5							
RADIFLAT	Radar-based strip flatness control	2							
DYNREACT	Re-routing and Re-scheduling	5							
AUTOSURVEILLANCE	Detection software for cyberattacks	5							