

### INTRODUCTION

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The generic validation scheme has two parts, combining both engineering and management. The first part consists of the matchmaking process embedded in the EPOS toolbox (engineering); the matchmaking process validates the shareable streams to be integrated into the EPOS toolbox (industrial symbiosis (IS) building blocks). The second part consists of an interactive LESTS score that supports the process of validation from a management perspective. By using the scheme, an industry or economic player can quickly detect which barriers have to be addressed before a given IS project can be implemented.

LESTS scores provide a screening procedure for IS initiatives previously validated from an engineering perspective (matchmaking process). The scheme provided in Figure 1 provides a synthesis of lessons learned and methods developed in a simple to use format, easily accessible to industries and stakeholders.

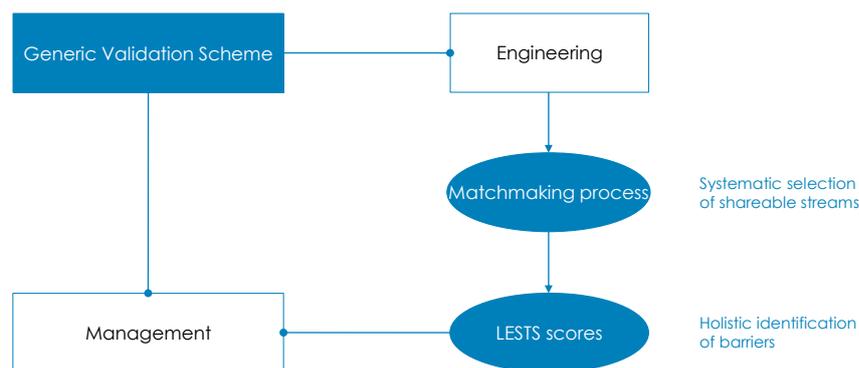


Figure 1: Generic validation scheme

### ENGINEERING: MATCHMAKING PROCESS

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The shareable streams in the EPOS toolbox are the result of a matchmaking process. This process is based on the sector expert knowledge and a cross-sectorial research focus.

#### Process description

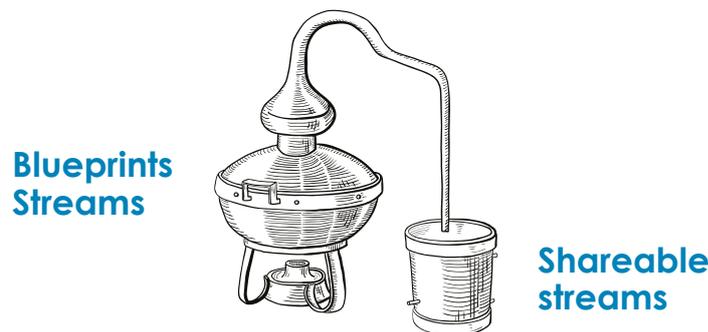
The EPOS blueprints contain more than 400 streams characterised at different levels. However, an expert of one sector has limited knowledge of other sectors. To overcome this challenge, a four-stage process was developed. This process enables a systematic analysis of the common streams, that are listed according to a generic classification. The four-stage process is depicted in Figure 2.

In the first step, all the streams in a sector blueprint are quantified and classified by the blueprint developer. In the second step, the blueprint developer identifies the streams usable for symbiosis streams. In the third step, the developer scans other blueprints to offer or request a stream for symbiosis for or from another sector. In the final stage, the other sectors confirm that the potential shareable streams can be connected between the different blueprints. The suitability of a stream is determined by quality and process parameters.



Figure 2: Matchmaking process

After screening the EPOS sectors, the product is a collection of 28 streams related to heat, fuel and materials exchanges among the different blueprints. All of which are based on case collections from both the EPOS and MAESTRI projects [1].



## MANAGEMENT: LESTS SCORES

The LESTS scores support the user in the decision-making process by considering the five different LESTS dimensions at different operational levels. The final score provides a first generic orientation of the feasibility of the IS project from a managerial point of view.

The LESTS scores is a checklist that covers the five LESTS dimensions: Legal, Economic, Spatial, Technical and Social [2][3]. For each **dimension**, there are three questions corresponding to different operational levels (Figure 3). The first is the strategy level (top, policy level), the second is readiness level (company/cluster level) and the third is the shareable stream level.

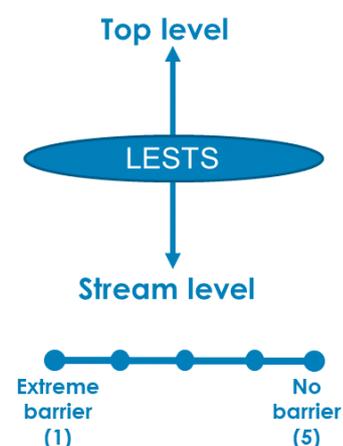


Figure 3: Operational levels

The answers to the LESTS points are scored on a Likert scale [4], as shown in Table 1. The scale ranges from an extreme barrier, inhibiting the IS project (value of 1), to no barrier detected (value of 5) for that specific case. By making use of the scale, the user can screen the IS readiness level of the IS optimisation solution. The average of the scores for the three levels for each of the five dimensions is graphically presented in a pentagon (Figure 4). The user is able to see the barriers of a symbiosis in a glance. By representing different synergies in the same plot, one can identify common LESTS barriers in a cluster.

	LEGAL	L Q1	Policy/regulation
		L Q2	Readiness to close deal
		L Q3	Permit requirements
	ECONOMIC	E Q1	Public funds
		E Q2	Readiness to invest
		E Q3	Payback requirements
	SPATIAL	S <sub>p</sub> Q1	Regional planning
		S <sub>p</sub> Q2	Readiness of land
		S <sub>p</sub> Q3	Transport requirements
	TECHNICAL	T Q1	Existing infrastructure
		T Q2	Readiness of technology
		T Q3	Expertise requirements
	SOCIAL	S <sub>o</sub> Q1	Community acceptance
		S <sub>o</sub> Q2	Readiness to collaborate
		S <sub>o</sub> Q3	HSE/CSR impact

Table 1: LESTS Scores checklist

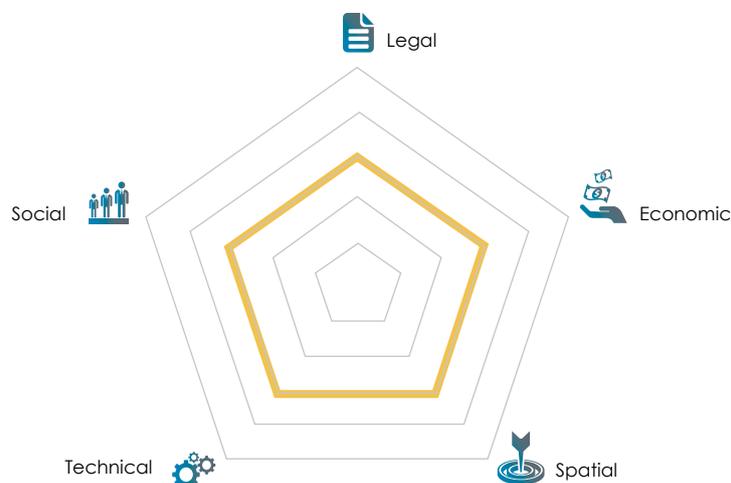


Figure 4: LESTS pentagon

The LESTS score indicates the barriers for IS implementation. It evaluates the potential of an IS project as follows: if there is no low score (readiness levels 1 or 2) in any of the dimensions and a total average is above the score of 3, then the symbiosis is declared to have potential for implementation. When the above-mentioned criteria are not met, the barriers on specific synergies are the subject of critical mitigation plans, if the synergy is still considered as feasible by the stakeholders after identifying the barriers.

The risk for bias, inherent when using a Likert scale, can be mitigated by involving experts with roles at different levels and with different expertise [4].

## CONCLUSION

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From the management and engineering perspectives, the output of the EPOS toolbox is validated by this scheme. The management perspective is related to the holistic identification of barriers when planning IS projects. The engineering perspective is related to the matchmaking process detecting validated shareable streams. This scheme represents a great step further in the EPOS project, as it enables the identification of material-based synergies and integrates managerial aspects into the EPOS toolbox.

The matchmaking categories can provide the starting point for an ontology design.

It is also useful for integrating additional blueprints efficiently into the EPOS toolbox.

## REFERENCES

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- [4] T. Rinker, "On the Treatment of Likert Data," University at Buffalo, Department of Learning and Instruction, May 2014.



## COLOPHON

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