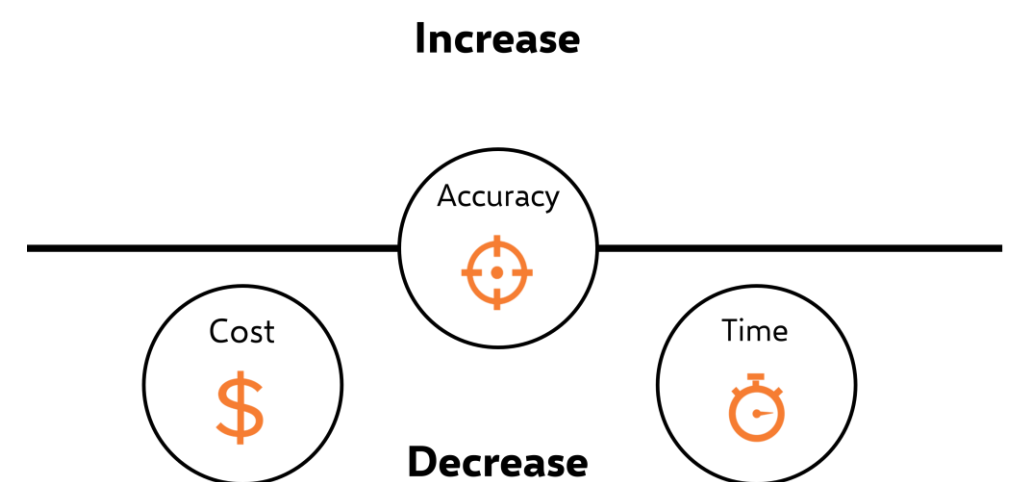


Efficiency optimisation of the prototyping process for injection moulding

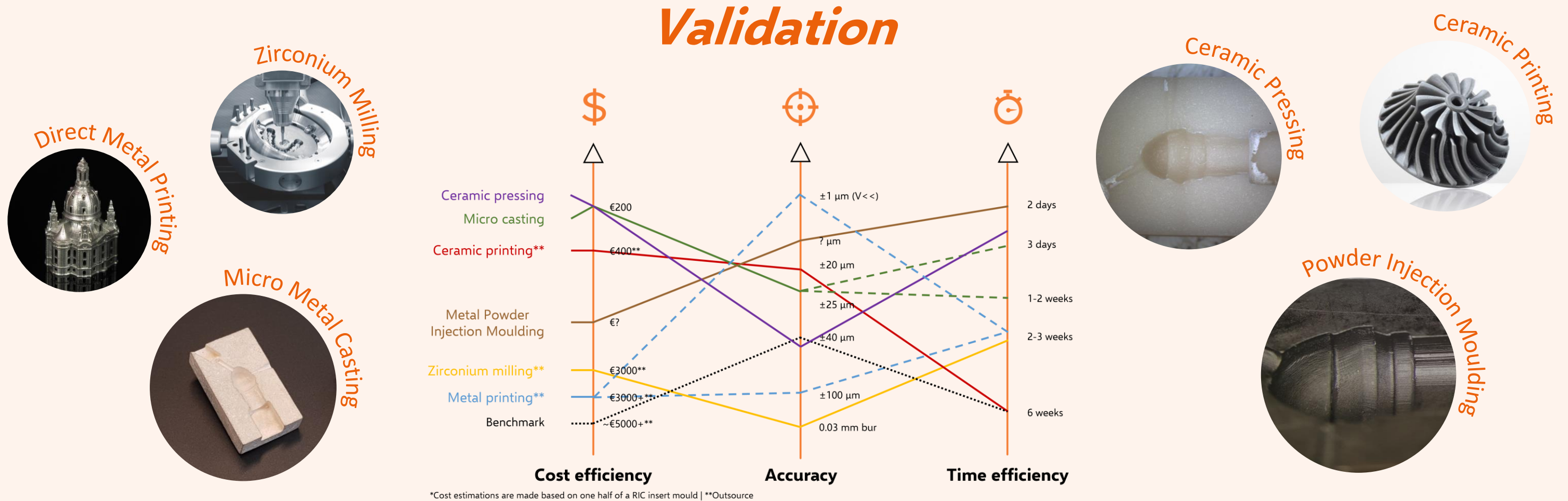


Project goal

The goal was to develop a process that reduces the cost and the time to manufacture an injection mould while maintaining a similar accuracy as in conventional mould production. Usually, Sonion outsources the production of injected moulded parts, resulting in parts with a tolerance of $\sim \pm 10 \mu\text{m}$ that cost **€15.000** for a 1000 pieces with a delivery time of **6-8 weeks**. For Sonion's development process, which is prototype heavy, this is too expensive and takes too much time. A micro injection moulding machine is acquired to shorten the iteration time of their design process and to reduce cost.



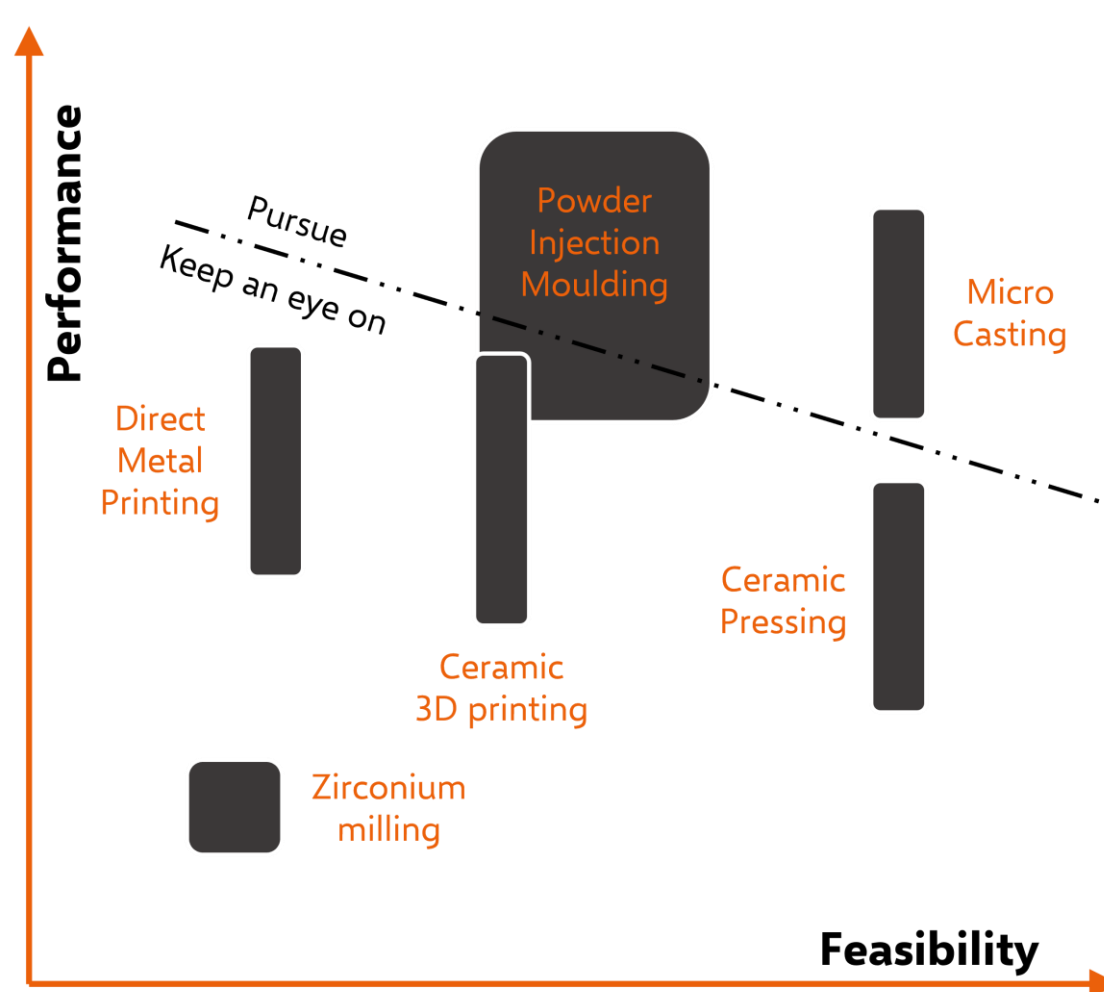
Validation



After the scope exploration, the performance on all criteria of the six most promising methods were determined. Validation was done through testing, research and consulting experts. The method's performances on the three main requirements can be seen in the figure above. Forming a well-founded recommendation was done by plotting the performance against the feasibility, revealing the most optimal methods.

Metal Micro Casting

Metal Micro Casting, a derivative of the lost wax casting technique, was chosen for its accurate ($\pm 25 \mu\text{m}$), low cost ($\sim \text{€}750$) and relatively short production time (1-2 weeks). Due to the thermal resistant properties of metal, consistently accurate parts should be mouldable. For this reason, it is recommended to continue development of this method for it is not yet ready to be fully integrated. Primary focus should be testing if the surface roughness is low enough for usage.



Powder Injection Moulding

In this method, the injection moulding machine is used to produce its own mould. At only $190 \text{ }^\circ\text{C}$, a fine metal grain with a polymeric binder can be injected into 3D printed moulds to produce a mould. Although this method could not be tested to the extend other methods were tested, it is very promising due to its accurate properties. Therefore, it is suggested to continue research and to exploit the initiated collaboration for the production of steel moulds.

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