Assessing the Value of Digital Technologies: A Case Study on Humanoid Robot Assistance in Neurorehabilitation

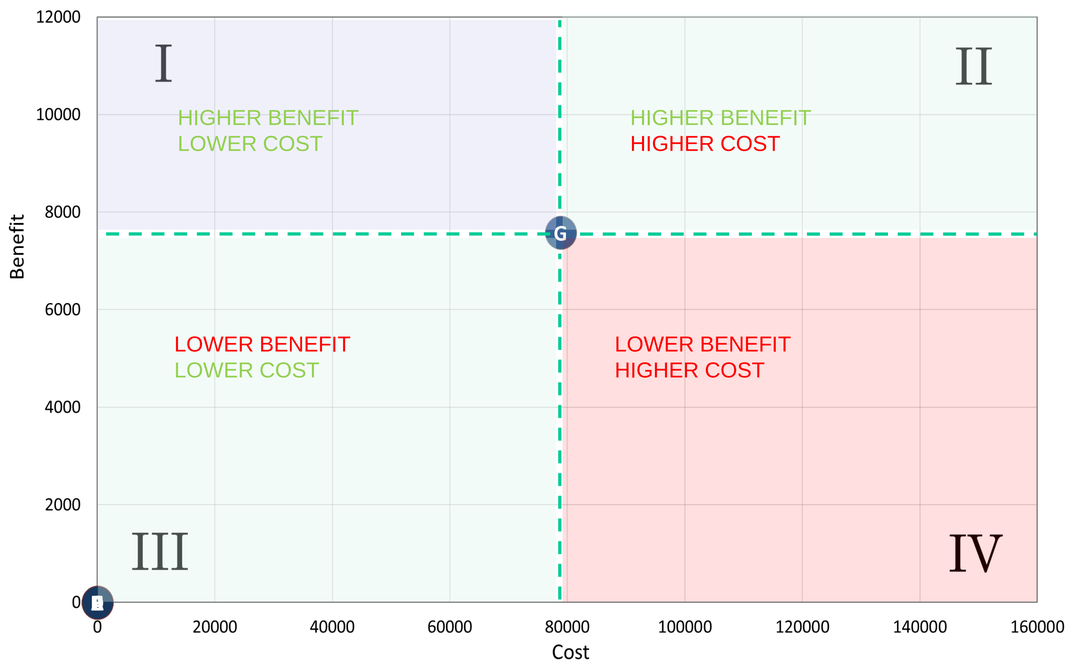
Mühlbacher A[1,2], Sadler A[2]

[1]Hochschule Neubrandenburg, Neubrandenburg, Germany, [2]Gesellschaft für empirische Beratung GmbH (GEB), Berlin, Germany

Code: EE652

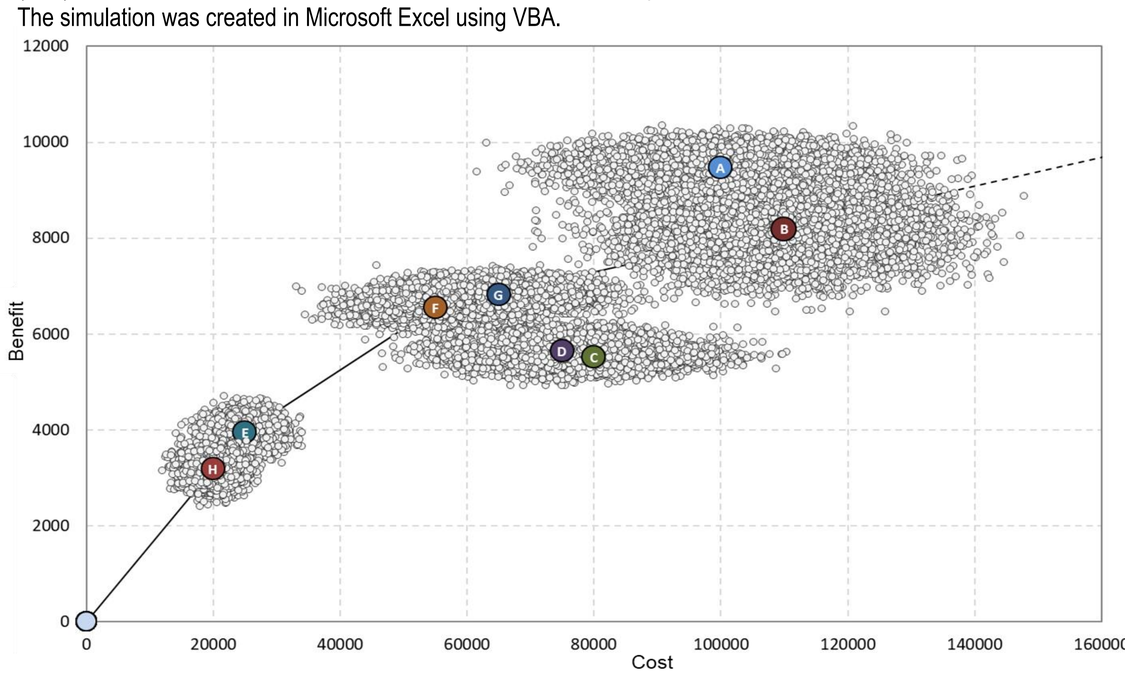
OBJECTIVES: This case study employed a methodological approach to examine the value of a digital application, specifically focusing on a humanoid robot in neurorehabilitation for stroke survivors. The objective of the case study was to simulate efficiency of digital applications using a value assessment framework (VAF).

Figure 1: Cost-benefit threshold depending on the most cost-effective alternative



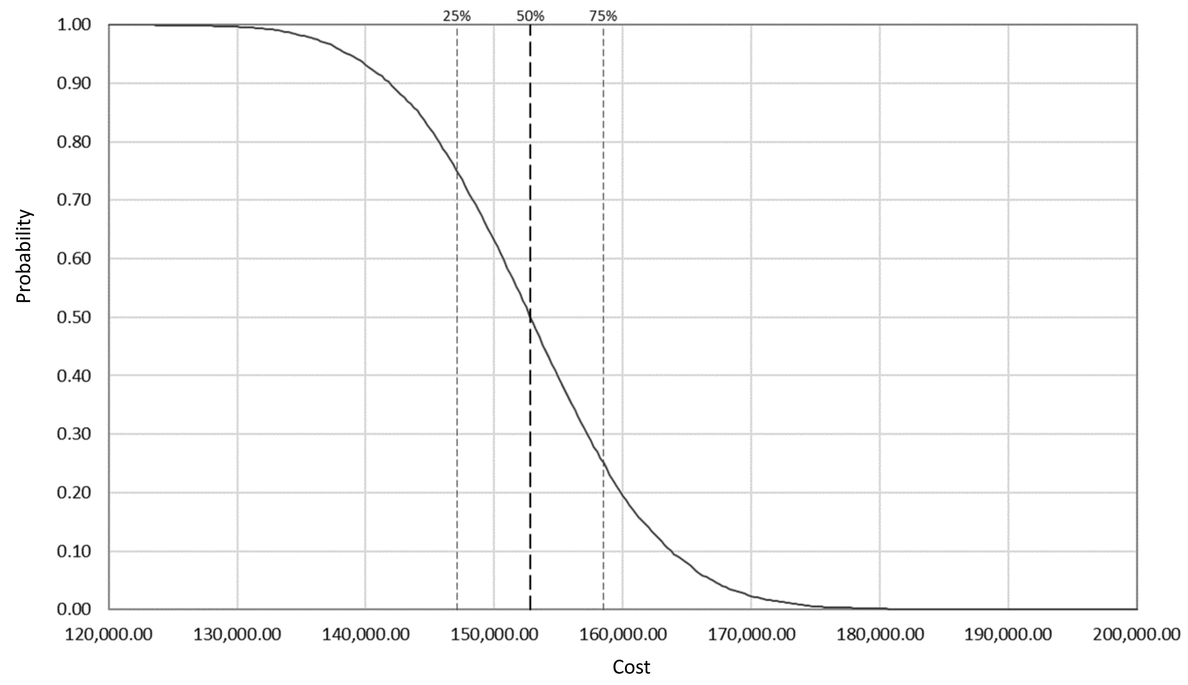
METHODS: Value was assessed through an efficiency frontier (EF) using probabilistic simulation. Various tools were employed to evaluate and visually depict parameter uncertainty. Uncertainties regarding reimbursement prices were assessed using price acceptance curves (PAC) and net monetary benefit (NMB). Risk acceptability curves (RAC) and net risk benefit (NRB) diagrams were employed to support informed decision-making based on risk tolerance.

Figure 2: Efficiency frontier simulation after 10,000 iterations considering uncertainty.
Solid line shows the efficiency frontier with the most cost-effective alternatives; dashed line marks the extrapolated efficiency frontier. The extrapolation shows the incremental cost-benefit ratio used to assess a (new) intervention with more benefits and more costs than the comparators.
The simulation was created in Microsoft Excel using VBA.



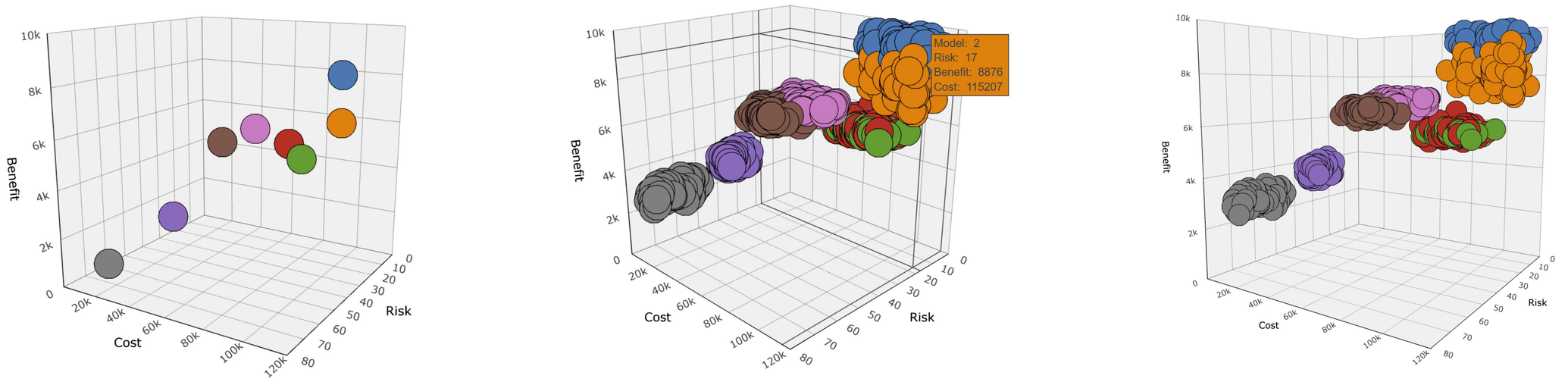
RESULTS: A probabilistic model was used to compare the benefits, costs, and risks associated with the utilization of a humanoid robot in comparison to alternative treatment methods. In the simulation, all treatment methods were plotted and compared over 10,000 iterations. The application of PAC assisted in estimating the range of reimbursement prices, effectively addressing uncertainties. NMB analysis was conducted to assess whether costs were justified or inefficient based on a predetermined threshold. The RAC and NRB provided visual representations of the threshold at which potential risks outweigh the associated benefits and when the level of risk becomes unacceptable.

Figure 3: Price acceptability curve.
The curve shows the probability that the cost-effectiveness of an intervention depends on the price. Price is considered appropriate only if it is at the maximum of the extrapolated efficiency frontier with the best cost-benefit ratio to date. Product may be more expensive than the status quo as long as additional benefits can be provided.



CONCLUSION: This case study provided a comprehensive framework for evaluating the impact of digital healthcare interventions. The study addressed methodological challenges, such as weighting clinical endpoints, aggregating relevant parameters into a utility function, and visually representing parameter uncertainties. The simulation of artificial data, assumptions of linearity, and reliance on normal distributions of effects limits applicability and affects the study's robustness. Nevertheless, the transparent and reproducible VAF enhances the understanding of decision-making processes and facilitates informed reimbursement decisions and negotiations in the healthcare sector.

Figure 4: 3D chart.
The 3D chart provides insights into probability distributions, offers a comprehensive risk analysis, and highlights correlations among costs, benefits, and risks.
All 3D charts and graphics were created in R (version 4.3.1) using the plotly package (version 4.10.3).



Conflict disclosure: The study is funded by European Funds ESF, EFRE and ELER. The author declares no further conflicts of interests.

2023-11, ISPOR Europe 2023, Copenhagen, Denmark