Biodegradable implants such as bone plates, screws and blood vessel stents are designed to stabilise damaged tissues in the human body temporarily until their natural healing process has advanced sufficiently. Dissolving of the implant during the healing process by degradation avoids additional surgery to remove the implant. Magnesium alloys are promising candidate materials for this purpose due to their biocompatibility, lightness and adjustable degradation rate. Their clinical success crucially depends on the ability to predict and tailor their degradation rates specifically for the biochemical environment in individual patients. To this end, one requires a digital twin modelling their biocorrosion and their related loss of mechanical strength. Current study develops a multiphysics model of the degradation mechanism as well as the reduction of mechanical performance of biodegradable magnesium implants. The resulting digital design tool is applied to Magnesium-Gadolinium (Mg-Gd) alloys. It is based on a diffusion model using a Peridynamic (PD) approach sequentially coupled with finite element mechanical analysis using damage mechanics. This hybrid framework will allow tracking the decline of the load carrying capacity of the implant over time as the degradation progresses. Predicted results are validated against degradation experiments, microstructural investigations and micro-/macro-mechanical tests.