Bio-based production of chemical building blocks from renewable resources is an attractive alternative to petroleum-based platform chemicals. Metabolic pathway and strain engineering is the key element in constructing robust microbial chemical factories within the constraints of cost effective production. Here we discuss how the development of computational algorithms, novel modules and methods, omics-based techniques combined with modeling refinement are enabling reduction in development time and thus advance the field of industrial biotechnology. We further discuss how recent technological developments contribute to the development of novel cell factories for the production of the building block chemicals: adipic acid, succinic acid and 3-hydroxypropionic acid.