Confronting Projects Complexity

An Engineering Project Management by Design approach

A.R.M. (Rogier) Wolfert

Confronting Projects Complexity: designing towards a best-fit for common purpose

What prevents us from achieving results that best fit a common purpose? Why projects often result in building what nobody wants, or projects that derail. Actually, these projects don't go wrong — they start wrong. And when they start right, they can still lose direction. Even the most advanced design and project management practices can hit impasses, leaving decision-makers struggling with multifaceted challenges. Traditional systems engineering and management sciences do not provide a constructive way out either, causing society to miss valuable opportunities towards a common ideal within reach. If only they realized that their puzzle was part of a bigger puzzle —and avoided fixation or bias to any curated outcome.

What's needed is an open, holistic design approach capable of confronting complexity, supported by robust decision-making systems. Odesys, a pioneering methodology developed by Prof. Wolfert at TU Delft, offers an open design systems approach, successfully applied in industry to tackle complex challenges. Its three-step 'systems thinking slow' process—(1) agree first, (2) act feasibly, (3) adapt flexibly— aims for synthesis to arrive at best-fit for common purpose solutions. Odesys turns complex decision-making right side up—putting decisions back on track

Odesys builds 'actionable bridges to anywhere', proven effective in fostering project management practices across various sectors. It untangles wicked problems whilst balancing individual design freedom, human equality, and stakeholder fraternity, to ultimately achieve feasible and purposeful outcomes best for projects and people.

Explore in this book how Odesys' innovative methodologies applied to real-world complex projects, can incite you to awaken your inner designer and confront complexity into success!

Dr. A.R.M. (Rogier) Wolfert

A distinguished professional in integrative design and management, Dr. Wolfert brings over 30 years of work-experience with leading service providers, including VolkerWessels, Hochtief, Fluor, T-Mobile, and Huawei, among others. Currently, he is a project director at Boskalis and managing associate at Odesys cv, where he pioneers human-centred and model-based management approaches using open design systems while also educating 'young stars' to confront complex engineering management challenges.

As a former professor at Delft University of Technology, he effectively bridges the gap between engineering and management, academia and industry, as well as research and development. His unique blend of academic rigor and real-world expertise drives significant improvements, enhancing performance, participation, and purpose across various sectors. Lastly, he considers both 'outer' observation and 'inner' experience essential companions on his odyssey into the emerging future.

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'All real living is confronting the other(ness). Without genuine dialogues, there is no creation.'

-Martin Buber-

'Le cœur a ses raisons que la raison ne connaît point.'

-Blaise Pascal-

'Notwendig sind der Spiel- und Geisttrieb, nicht nur der Sach- und Formtrieb.'

-Friedrich Schiller-

'Alles van waarde is weerloos'

-Lucebert-

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'Becoming aware of the idea within reality is the true communion of man.'

-Rudolf Steiner-

'There is nothing more frightful than ignorance in action.'

-Johann Wolfgang von Goethe-

'Beauty is in the eye of the beholder.'

-David Hume-

Preface

What prevents us from achieving results that best fit a common purpose? In today's complex landscape of project development in the built environment, 'wicked problems' often result in building what nobody wants, or projects that derail. Actually, projects don't *go* wrong — they *start* wrong. And when they start right, they can still *lose direction*. Even advanced design and project management practices can hit impasses, as decision-makers fail to recognize that their challenges are part of a larger, interconnected whole. Mutual interconnection and collaboration are keys to unlocking complex projects best-fit for a common purpose.

Although complex projects eventually come to an end, we should not wonder how or whether stakeholders are truly 'satisficing'. Projects often end this way due to a lack of full stakeholder buy-in and a feasible plan from the very beginning. Along the way, projects can get out of control because they are managed as 'sealed systems', unable to openly and dynamically adapt to a best-fit solution for a common purpose. This is exacerbated by current project decision support, which is often non-inclusive, single-sided, and lacking in transparency, while complexity goes beyond the comprehension of project managers.

Traditional management sciences and their decision-support methods often rely on retrospective analyses, offering little guidance for constructive ways forward. As a result, society misses valuable opportunities to strive toward a common ideal that is within reach. While management science provides valuable insights, its retrospective focus often results in stakeholder wishful thinking and post-mortem project analyses, rather than 'walking their talk.' Consequently, projects remain stuck, lacking an actionable response to deliver a tangible, best-fit for common purpose solution. Similarly, state-of-the-art systems engineering lacks a genuinely holistic approach as it often ignores the dynamic interplay between the preferences of multiple stakeholders ('what they want') and the capabilities of the system ('what it can do'). As a result, these methodologies fail to reflect the actual design process and rarely arrive at a best-fit solution that integrates these complex needs. Above all, they often engage in a purely technical discourse, where an explorative model becomes an opinion in a mathematical form rather than integrating the various opinions into an open and normative model.

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What's needed is an open, holistic design approach capable of effectively confronting complexity. This approach should be supported by robust participatory decision-making models that leverage collaborative intelligence to align aggregated stakeholder preferences with the best possible realisation — while avoiding the exclusion of potential solutions upfront (hence not limited to a set of curated options). If complexity is approached synthetically by design through systems thinking, there seems to be no limit to the complexity we can handle effectively. Through an open design systems approach, there seems to be no limit to the complexity we can handle effectively. By designing with both individual stakeholder freedom and systems degrees of freedom, we can work toward the best common ideal within physical reach. Moreover, resolving creative conflicts requires transparent reflection while avoiding fixation or bias towards any particular outcome. Decision-support models are crucial in this process, simplifying complexities and clarifying challenges, enabling people to navigate what they cannot immediately and fully grasp, as such calculations are beyond the capacities of the human mind and require computational support. These models should evolve to integrate human's collective intelligence, ensuring they foster social development rather than impose one-sided materialistic models that suppress creativity and the dynamism of life. This, in turn, requires a model-based approach where the interconnectedness of things is central, the subjective human experience is integrated, and where no single component is considered absolute. We need an approach beyond pure 'bookkeeper's calculus', where one-sidedness is the starting point, but rather a 'system architects' design approach where the whole is greater than the sum of the parts but their interactions determine the whole. Systems design focuses on how things ought to be, transforming existing situations into preferred ones based on people's intent, shared values, project performance and sociotechnical constraints. This calls for pure solutions to complex problems through a holistic design approach where the art of integration and association merge. With this design approach, complexity can be unlocked by stepping away from predetermined outcomes to explore an optimal solution within an open systems space rather than settling for a sub-optimal alternative within a closed space.

Such a novel model-based open design systems approach will turn decision-making upside down and right side up, guiding it toward a

pure direct-democratic form that delivers realistic results in a neutral, unbiased conflict, namely by: (1) *reversing* sub-optimal compromises after the fact *to optimal strategic synthesis from the start*; (2) *shifting* from a vertical top-down hierarchy *to a horizontal network association*, while participatorily balancing individual *design freedom, human equality, and stakeholder fraternity*, (3) *transitioning* from a technical, single-sided view *to a human-centered, ingenuity-driven approach* that integrates idealism with realism. This represents a *paradigm shift in decision-making*, where the principle of *allegedly free choice* — often restricted to selecting from curated options — transforms into genuinely designing from a neutral space of *'infinite'* freedom, while uniting idealism and realism from the outset. This process ultimately leads to a best-fit synthesis for a common purpose that is socio-technically feasible and acceptable to all stakeholders. Moreover, this design approach embraces the social threefold principles of freedom, equality, and fraternity, whilst unlocking a best set of degrees of freedom within a design space that accounts for both physical and non-physical constraints. In this manner, this multifaceted approach compasses toward *satisficing*, *salutary* and *solidary* project *success* within a *solvable* reach. All of this is ultimately aimed at purposeful results that are best for projects and people. That is to say, Odesys transforms the concept of allegedly free choice into an open and pure design process — one that best fits a common purpose — by integrating social and physical systems dynamics and associating the collective 'wisdom' of the group.

In recent years, under the leadership of Prof Wolfert at TU Delft, the open design systems methodology known as 'Odesys' has been developed to optimally unite 'desirability' and 'capability' as an active response to complexity. Odesys is a pure form of socio-technical systems integration that proactively unlocks creative conflicts of multiple interests, right from the outset rather than after the fact. It embraces the paradox of conflict resolution: the closer you aim for a lasting solution, the longer you must stay away from a concrete outcome — calling for design as the art of problem-solving and decision-making. The only way to achieve results from complex problem-solving is to engage people at all levels in the process of design. Designing conflict resolutions requires a conscious of 'inner-outer' dialoguing approach that transforms destructive patterns into constructive solutions. By considering both all

stakeholder preferences and system performances, Odesys optimally explores and maximizes the solution space, leading to a best-fit for common purpose solution, where value extends beyond money or technology alone. It untangles wicked problems whilst embracing the social threefold principles of individual design freedom, human equality, and stakeholder fraternity, promoting a purposeful and balanced project compass. In doing so, Odesys offers both a tangible solution and a valuable contribution to the emergence of new forms of local communities and their direct-democratic decision-making processes. It also fosters enhanced public-private collaboration, enabling all parties to pursue the best outcomes for the project and people across the entire value chain, rather than settling for sub-optimal outcomes that benefit only individual stakeholders. So when stakeholders dare to confront their conflicts and lay their 'cards' openly on the table, the possibility of achieving a pure, best-fit solution for common purpose becomes real.

Odesys makes this all possible through its unique integrative multi-objective optimisation method, known as IMAP, which maximises the weighted aggregated preferences as functions of objectives and design performances within a multi-dimensional solution space. It delivers a set of controllable design variables- a best configuration- for this maximum aggregation This novel multi-objective design optimisation (MODO) method integrates both objective and subjective objectives, which align in a way with the Vitruvian threefold of physics, utility and beauty ('firmitas, utilitas, and venustas'). These objectives that can only be goal-oriented by humans are expressions of his preference - what it is of value (or holds utility) to them. Preference reflects the degree of 'satisfaction' or 'well-being'— a human experience of infinity across all the senses. Notably, money, like other subjective objectives, is not a property of an object but is a subjective expression of an individual's actual willingness to pay —his appetite to exchange— reflecting what it is worth for him. Rooted in the theory of pure economics and preference functions modeling (PFM), IMAP operates from the paradigm of a-priori maximising preferences as a measure of overall 'well-being value' rather than minimising the lowest monetised costs. Effective decision-makers consider both economic, isonomic, and ecological systems aspects, recognizing that pure preference value extends beyond

monetary terms. With this, everything that counts, even that which is defenceless, becomes valued and countable.

IMAP design optimisation provides substance to 'true free choice' and is consistent with the direct-democratic preferendum principle, as opposed to a referendum, which is a decision analysis based on curated options derived by others. One could actually argue that a 'curated solution' is a root cause of the problem. IMAP integrates people's preferences with physical performance, and associates different stakeholder weighted interests. In this dynamic and open search for the maximum group preference, Odesys employs a robust and mathematically rigorous decision-support tool called the Preferendus. This IMAP-based Preferendus aims for synthesis to arrive at a single best design point that represents a set of design variables for an optimal configuration. IMAP outperforms traditional (parametric) optimisation methods, avoiding suboptimal compromises and invalid Pareto front solutions.

Most recently, Odycon, an Odesys-based project management method, has been further developed for dynamic project planning and control. Current probabilistic planning methods fail to model the mitigation-driven behavior of project managers. Therefore, Odycon combines IMAP optimisation with probabilistic Monte Carlo simulation, offering an optimal synthesis for both the strategic project planning and dynamic project control phases. For the latter, Odycon enables an a-priori search for the best set of mitigation strategies on-the-run, rather than relying on a-posteriori evaluations of potentially sub-optimal and over-designed mitigation strategies, that often result when applying scheduling software such as Primavera P6.

Odycon and Odesys are both multi-objective systems design approaches that generate optimal project development plans and dynamic planning and control strategies, surpassing human limitations to fully comprehend complexity. When confronting complexity, they employ a threefold process — *'systems thinking slow to..'* : (1) .. *agree first* , (2) .. *act feasibly*, and (3) .. *adapt flexibly* —, to arrive at best-fit for common purpose solutions for the development, deployment and execution phases respectively. This 'systems thinking' approach follows the principle of "You need to step back to see the bigger picture". Moreover, this deliberative 'thinking slow' or systems-2 approach (as opposed to the instinctive systems-1) prevents projects from going off track by starting in

a well-supported, participatory, and realistic manner, while enabling deliberate, on-the-run adjustments throughout execution.

Overall, Odesys and Odycon support (1) the *creation of no-regret project plans* rooted in common interest which builds the right scope and avoid 'sunk costs', and (2) the *effective and efficient dynamic project control* on-the-run through an open R&D-like mindset that minimises 'failure costs'. In doing so, they truly embody the sayings: "Better to turn back halfway than to go all the way wrong" or "You need to stand still in order to progress". Odesys/Odycon have now proven their value in several infrastructure and estate planning applications, both in public and private contexts. More specifically, through the "vertical" integration of desirability ('subject') and capability ('object'), they demonstrated that their solutions are both wanted and realisable. In this way, ideality, as expressed through stakeholders' preferences, is transformed into reality, ensuring physical feasibility, as nature cannot be deceived. Through the "horizontal" (network) association, individual stakeholder interests are aggregated to a maximum preferred value. It has been shown that when an individual stakeholder is willing to relinquish pure self-interest ('single-objective -SODO'), it becomes possible to create a best-fit for a common purpose that benefits the whole group the most ('multi-objective' - MODO). In other words, the IMAP-based MODO methodology always maximise the solution space and outperform single objective or min-max optimisation methods. Unlike min-max, which relies on an inclusive compromise solution to 'leave no one behind,' IMAP aims for holistic synthesis to achieve a solution that serves the 'greater good'.

In all of the design applications, the IMAP-based Preferendus proved to be a central decision-support tool at the heart of the group decision-making process. It enabled a concrete transformation of people's plans and preferences from their minds into a best possible materialisation. This is an iterative and open design learning process in which the Preferendus reflects and 'talks back'. By deploying the Preferendus, not only were several sufficing solutions found within a maximum solution space of collective stakeholder intelligences, but the Preferendus also built trust through its transparency and traceability. This shifted an initial process of mistrust and black box modeling into a glass box model that maximally supported the group in their socio-technical process,

where the full potential of the participants could be realised by this way of open design learning. By embracing the principle of being *for others*, Odesys cultivates a collaborative design process that transcends self-interest and aims for feasible solutions that embody *brotherhood, equity,* and *purpose.* Such pure solutions emerge not through competition, but for each other — fostering a spirit of mutual-aid toward the best-fit.

In this context, Odesys and its Preferendus go a step beyond single-loop (DMI) and double-loop (DMII) learning by integrating their methodology into open-loops learning as part of the Odesys U-model. This process brings together the technical, social and purpose-driven open-loops (DMIII). Conflicts of interest are not only inevitable but also essential for a development process; they serve as opportunities for growth and co-creation by engaging in dialogue with the 'inner-outer' in the now. In a complex world, the most effective solutions come from dialogue, rather than through authoritative decision-making. This Odesys U-way of working has been successfully applied, validated, and further developed in public and private projects within the infrastructure and built environment sectors.

Odesys builds 'actionable bridges to anywhere', proven effective in fostering engineering asset management, project management, and construction management. They unlock wicked problems by navigating with their project compass, to ultimately achieve purposeful outcomes best for projects and people. Everyone has a designer within themselves; it is the art of Odesys to awaken this inner designer. Please keep the following 'wise sayings' by the famous football-philosopher Johan Cruyff in mind on your 'awakening odyssey':

"You'll only see it once you understand it";
"You can only score if you're in play, not offside";
"You can't do anything alone; you have to do it together";
"You play football with your mind, as the ball outpaces your legs".

A final reading note. This book does not take the classic form of a scientific book in which references to existing concepts and/or relevant literature are either included in the text with references or footnotes.

Instead, the author has chosen to use Incitements (at the beginning or end of a section) in which quotes from a number of important 'predecessors' are included. Also included is a list of reference works by which he was inspired. In this playful way, the author hopes to refer the reader to the sources of Odesys and Odycon. Finally, the author has chosen not to include mathematical material or weave theoretical background into the main text. Readers are referred to the author's Open Design Systems book, or to other publications by him. To facilitate independent reading, this book does include a Capita Selecta, with the key summary of some of these essential concepts.

The Opening describes 'the paradox of closed complexity's doors', in which Chapter 1 summarises the actionable keys to really open these doors. Both chapters, in addition to the aforementioned incitements, are larded with Interludes to introduce the reader to the concepts, issues and or problems from a slightly different context. Chapter 2 demonstrates the application and contribution of Odesys and Odycon on the basis of real-life complex projects. Chapter 3 introduces the process of open-loops management that explains the metamorphosis of a project organisation as a complex system, as well as its dynamic systems design and management transformation through the U-model. The book concludes with a look forward of possible applications and further developments.

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Short Bio

Dr. A.R.M. [Rogier] Wolfert has established a unique combination of proven academic and industrial track records in which he has been involved in the design and management of various types of infrastructure. Over the past 30 years, he has worked at various companies and universities, developing state-of-the-art concepts and methods, producing numerous significant publications, and establishing and lecturing in newly created MSc courses on systems design and management through his Open Design Learning (ODL) teaching concept. He has contributed to innovative projects and pioneering people by fostering an open design systems approach, called Odesys, to confronting complexity. He has strong experience in project management practices with services providers such as VOLKERWESSELS, HOCHTIEF, FLUOR, T-MOBILE,

and HUAWEI, among others. He is currently project director at BOSKALIS, where he drives new developments in data-driven decision science and engineering to enhance project management and business operations.

He is also the founder of ODESYS CV, which was established by a group of former TU DELFT students. They recognized the potential of the Odesys methodology during their projects with leading companies such as TOTALENERGIES, MICROSOFT, and BAM, as well as public organisations like RIJKSWATERSTAAT and the municipality of WESTLAND. Through ODESYS CV, he aims to effectively cultivate the 'Odesys philosophy' in real-world project management offices, utilizing their systems of interest while educating the next generation of Odesys enthusiasts. Moreover, he is eager to further develop and promote the Odesys and Odycon methodologies within international engineering management faculties and renowned business schools at leading universities.

He is highly adept at bridging traditional gaps between engineering and management, academia and industry, research and development, as well as the realms of mind and matter. As a true systems integrator, he is very much able to connect different domains and parties while retaining their strong individual values.

He is a former professor from DELFT UNIVERSITY OF TECHNOLOGY where he also received his Doctor (PhD) and Master (MSc) degrees. He held the chair in Engineering Asset Management and lectured in project management systems, engineering systems design, engineering asset management, information systems and R&D methodology. Renowned for his innovative educational approach, he is the founding father of the Open Design Learning (ODL) concept.

For more personal info:
https://www.linkedin.com/in/a-r-m-rogier-wolfert-a108b9303/
https://ebooks.iospress.nl/volume/open-design-systems

Selection of my recent publications related to this book:

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Confront Conflicts for Co-Creation: a Conspection

You think every conflict is a personal attack. Instead of listening, you start defending. You fight to be right instead of trying to understand. You immediately focus on a solution rather than listening to your wicked problem.

You think communication is about winning, but real communication isn't a competition. Every time you turn a conflict into a battle, you lose more than you win. You're not building bridges—you're destroying them.

You're not always right. If you can't handle that, you're going to push everyone away.

So stop. Stop transforming conversations into stalled conflicts. Stop fighting battles that don't need to be fought. Start learning to listen, not just defend. Start embracing an open design systems approach to untangle complexity, fostering constructive dialogues in an open space with the Preferendus as support in the middle. Start instead confronting conflicts as opportunities for co-creation, towards a best-fit-for-common purpose within socio-physical reach.

'To behold yourself in others will build new worlds.'

-Rudolf Steiner-