Stakeholder Inclusion as the Research Council of Norway's Silver Bullet

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Focusing on stakeholder inclusion, this article investigates the consequences of implementing the responsible research and innovation framework in a public funding regime. I use a Norwegian transdisciplinary project as a case study, demonstrating how the Research Council of Norway relies heavily on the assumption that stakeholders will pay for further development of the project as long as they are appropriately engaged. In analysing my case, I show how a real risk exists for a project that can potentially deliver value to society and address the grand challenges of our time ends up as waste. I refer to this as 4E Waste which I break into four types:

- *Economic Waste – when money put into the initial project becomes "worthless" because the research is not followed up,*
- *Eidetic Waste – where knowledge is lost when the community of practice that is building the novel understanding dissipates,*
- *Ecological Waste – when polluting practices associated with current production methods prevail, and*
- *Ethical Waste – when the potential enterprise becomes a missed chance to do something good.*

Keywords: RRI; stakeholder inclusion; funding policy; Mode 2 research

Someone needs to pick up the bill

Stakeholder inclusion and participation are essential in the international framework for Responsible Research and Innovation[1] (RRI) (Blok, 2014; Callegari & Mikhailova, 2021; De Jong et al., 2016; Klaassen et al., 2017; Owen et al., 2012; Owen et al., 2013; Parandian et al., 2012; Reber, 2018; Stilgoe et al., 2013; Von Schomberg, 2011). Policymakers from the second half of the 20th century became increasingly aware of the intertwined nature of science, innovation, and societal needs and considerations. Against this background, the RRI framework stimulates an explicit ethical use of what Nowotny et al. call the agora: "Knowledge […] needs to be 'socially robust,' because its validity is no longer determined solely, or predominantly, by narrowly circumscribed scientific communities, but by much wider communities" (2003: 191). Today, knowledge producers, disseminators,

traders, and users are required to engage in dialog with members of a broader public to make more considerations heard and make each party "mutual[ly] responsive to each other" (Von Schomberg, 2011: 9).

At its best, the inclusive and participatory agora functions as a democratizing event, steering things in a more desirable direction (Bäckstrand, 2006; Matten & Crane, 2005). But what if a country's main public funding institution applies the inclusion idea in ways that end up threatening what the RRI framework ultimately seeks to accomplish, namely a better society?

This is the central question of this paper. Engaged as an RRI researcher, I have worked with a Norwegian transdisciplinary project called BEDPAN. BEDPAN is a paradigmatic example of what Scott et al. (2003) call Mode 2 research. It involves bio- and nanotech, computer science, deep learning, metabolic modelling, wet-lab molecular biology, and (initial) industrial collaboration (DLN, 2021). The project seeks to develop a new approach to produce palladium nanoparticles using bacteria that naturally produce these particles (*E. coli*). The industry uses palladium nanoparticles in catalysts (the particles make CO_2 burn faster and cleaner and speed up chemical reactions) and products for targeted cancer treatment (the particles show magnetic properties in a certain size regime). BEDPAN was rewarded a four-year grant in 2018 through one of the Research Council of Norway's (henceforth the Council) strategic biotech initiatives: Centre for Digital Life Norway (henceforth Digital Life). The Council founded Digital Life as part of its more extensive BIOTEK2021 programme, with the explicit aim to boost biotech in transdisciplinary collaborations. Digital Life promotes "responsible innovation and value creation by encouraging more extensive and closer cooperation between biotechnological research groups and researchers in other disciplines and technology areas" (Hesjedal & Strand, 2021: 3). The grant application evaluation regarded BEDPAN as highly relevant for this aim, underlining the project's "large industrial and societal importance" (RCN, 2018: 3).

BEDPAN's financial support seems pertinent from a five-point utilitarian perspective. 1) The project generates new knowledge in a hot and emerging transdisciplinary field. Bio- and nanotechnologies exemplify new and emerging technologies crucial in transitioning to a greener economy (Calignano, 2017; EU, 2021). 2) Apart from the dangers of toxicity generally associated with large-scale nanoparticle production and biomedical applications (Miller & Wickson, 2015; van Dijk et al., 2017), no specific risks are involved—at least none known *today*. 3) One of BEDPAN's packages is dedicated to investigating the possible risks of nanoparticles, hence increasing the general knowledge in this field as well. 4) The biotechnological production method developed in the project is arguably favourable compared to the traditional way of producing palladium nanoparticles, which involve toxic chemicals and substantial energy. 5) The project will help counteract climate change and cancer, which represent two of the most significant threats to human life (Fisher et al., 2018; Mazzucato, 2018). Hence, taken together, the utilitarian calculus seems to end up on the plus side.

However, as I will try to demonstrate in what follows, BEDPAN is simultaneously thrown into what seems to be a predetermined track with probable unfortunate consequences. The Norwegian funding system lacks long-term core financing, and the Council seems to rely heavily on the assumption that stakeholders will emerge on the scene and pay for the project's further development

as long as they are appropriately engaged. Stakeholder inclusion appears to be *the* solution for realizing BEDPAN. Quite literally, stakeholders seem factored in as economic supporters of inventions. They are meant to pick up the bill at some critical point. But the problem is that no committed large-scale industry partner is on board as the four-year Digital Life funding is set to run out in mid-2023 (after an extension due to COVID-19). The attempts to include the partners and get them to pay the way for the research and innovation have not succeeded. As a result, the risk that a fourfold waste will happen is real, which I call *4E Waste*: *Economic Waste, Eidetic Waste*, *Ecological Waste*, and *Ethical Waste*.

Allow me to unpack my claim with a brief look at the Council's RRI policy and how it relates to the next section. In the following sections, I integrate observations from the BEDPAN Team.

RRI and funding

I conducted semi-structured interviews with several key members of the BEDPAN Team and led a group conversation on the RRI issues. All discussions were recorded (after participants signed written consent forms approved by the Norwegian Centre for Research Data). I asked open questions designed to encourage the researchers to reflect on the higher good of the project and (as turned out to be the focal theme) BEDPAN's enabling conditions for funding. While I transcribed all recorded interviews and used information for background information, this article mainly focuses on responses from BEDPAN's Project Leader who is also the Principal Investigator (henceforth Project Leader), originally from Germany. I also report statements from a central PhD Candidate (henceforth PhD Candidate) who has been part of BEDPAN's process from the beginning.

I target the case study through a quick look at the neat association of RRI, the Council's funding policy, and how it seems to play into BEDPAN's funding condition. RRI is a framework open to interpretations (RCN, 2015b; Rip, 2016; Wittrock et al., 2021), not an ethical theory.[2] The much-cited works of Stilgoe et al. (2013), Stilgoe (2015) and Von Schomberg (2011) suggest heuristic guidelines that arguably help to steer research and innovation in more desirable directions but not normative foundations in the philosophical sense. The framework emerged as a practice-oriented answer to a critical need to regulate the scientific community. In Gulbrandsen's phrasing (2016), RRI is "a wake-up call to a reality where science, technology and innovation are always already embedded in society and vice versa. As such, RRI invites a new attempt to mitigate the asymmetry that Jerry Ravetz articulated as follows in 1975: 'Science takes credit for penicillin, while Society takes the blame for the Bomb'" (unpaginated, alluding to Ravetz, 1975).

Since 2015, the Council has brought the RRI framework suggested by Owen et al. (2013), Stilgoe et al. (2013), and Von Schomberg (2011) to the core of how it organizes its portfolio (RCN, 2015a, 2015b). Inspired by the EU (2014) and the Engineering and Physical Sciences Research Council (EPSRC, 2021) in Great Britain, the Council highlights inclusion, anticipation, reflection, and responsiveness as critical (RCN, 2015b). By implementing the RRI framework, the Council seeks to develop what Arnold et al. (2019) call "the third generation of research funding." Whereas the first generation essentially delegated the choice of theme and quality control to the scientific community in the expectation that societal benefits would eventually appear (see Bush, 1995), and the second focused

on funding research and innovation to trigger economic growth, the third generation addresses the societal challenges head-on with targeted funding programs like Biotek2021 and Nanotek2021, and grants going through Digital Life. The fact that the Council is a monopolistic funding institution in Norway enhances the impact of these programmes. Simultaneously, the Council defines its role as a social actor through these measures (RCN, 2015a, 2015b), thus executing normative steering not only to the research community "out there," but also to themselves as a social actor.

That said, the Council is not one grand societal mastodon controlled by a mastermind with a complete overview of itself and its environment. While the Council is one of only a few institutions worldwide that take care of all the country's research funding (not, as in most other countries, dividing the national research council into several minor institutions with specialized target fields), the Council is something like a multiheaded troll with a variety of initiatives, strategic considerations and funding regimes. The implementation of the RRI framework seems to have emerged from inside this many-faceted institution in parallel with the main strategies associated with the large-scale technology programmes.

According to a 2017 evaluation of BIOTEK2021 (Angelis et al., 2017), the RRI implementation has been a success – at least partly. On the one hand, researchers report that RRI "is seen to be a loosely connected add-on to research programmes which lead to a 'boxticking' behaviour by applicants and hence has very little impact on actual research projects" (Angelis et al., 2017: 44). On the other hand, the evaluation also documents that there indeed "are some success stories of researchers working on projects funded from BIOTEK2021 who have experienced a change in how they (and their colleagues) conduct research" (Angelis et al., 2017: 35; see Egeland et al., 2019: 378, for a discussion of what this suggests in terms of learning). Similarly, another report discusses how there is a relatively high awareness of RRI concepts within Digital Life projects, yet also a "lack of clarity about how RRI activities are used in research practices; and ultimately how to mainstream RRI as a cross-cutting issue across the Digital Life and its infrastructure (Varnai et al., 2020: 23). These RRI evaluation reports focus on the behaviour of the researchers, however, what I have not seen discussed before is how the Council's RRI framework seems to have become baked into the modelling of the funding portfolios relevant to new and emerging technologies. Let's investigate this point more closely.

A research process like the one set in motion with this project can take ten to fifteen years, reflecting the amount of work needed to manipulate the bacteria's genomes, study the nanoparticles, stabilize the production process and scale up the process ready for industrial purposes. However, in Norway, a standard funding period (like the one awarded to BEDPAN) lasts only four years. Unlike Germany (where the Project Leader is from), for instance, Norway has no practice of rewarding core funding to keep a project group going for, say, twenty or thirty years. The advantage of the short-term funding regimes is that no research group or fixed set of research groups takes the whole cake. Instead, diverse research initiatives can flourish side by side – at least in theory. While the system, to some extent, is meritocratic, a democratic dimension is also embedded in the fact that all milieus compete on (more or less) equal footing.

The Project Leader was among the fortunate ones in the first round. But as we will see below, he also reports disadvantages with the system. According to him, the Council and universities point to each other to take responsibility for the longer developmental processes. Whereas the Council expects the universities to provide continuous funding just topped up by grants, the universities rely on the Council's funding regime to finance extraordinary achievements. Be that as it may, no long-term core funding exists for BEDPAN.

Against this background, we can begin to see how the Council seems to have built what appears to be a predetermined track meant to launch BEDPAN beyond the four years, hinging on stakeholder inclusion. In the RRI context, *stakeholder* can mean a wide variety of different societal actors with interests or concerns in research and innovation processes, such as private citizens, patients, or civil society organizations alongside the private sector – in short, various "publics." The current analysis will zoom in on only a fraction of these: the industries that are potentially relevant for BEDPAN's transdisciplinary research and development. Nowhere in the RNC's RRI documents or reports have I found this narrow understanding of the stakeholders explicitly articulated. But nevertheless, it seems the operative mode in the way things are done. The idea I am about to pursue is that a hallmark of the Council's third generation of research funding seems to be the distribution of the responsibility for innovation processes to the potential industry partners out there.

From an RRI perspective, two advantages of this funding model are democratization (Mazzonetto & Simone, 2018) and division of moral labour (Rip, 2018; Shelley Egan, 2011; Swierstra & Rip, 2007). A variety of people can decide which project "deserves" to be accomplished by choosing to pay its way. Thus, if we let the word *value* also mean *economic values*, Boenink and Kudina's observation is spot-on: "RRI [...] implies that stakeholders should – sometimes collectively and explicitly, sometimes in more limited settings and implicitly – deliberate on and decide about the values that innovations should contribute to" (2020: 451). However, as the BEDPAN project exemplifies, this reliance on stakeholders makes the process especially vulnerable. The potential stakeholders from the industries do not necessarily respond positively to the invitation of new and emerging technology. Without thereby saying that the potential stakeholders are ignorant, unimaginative or narrow-minded, it seems fair to say that their ideas of a good life don't necessarily overlap with the Council's ideas of co-funding new and emerging technologies. Yet the Council seems to consider stakeholders critical in selecting projects to be funded by establishing a funding portfolio based on the assumption that stakeholders will emerge on the scene and pay for the project's further development as long as they are appropriately engaged. In this sense, the RRI dimension of stakeholder inclusion and participation (Stilgoe (2015); Stilgoe et al. (2013); Von Schomberg (2011)) seems factored in as a silver bullet that will help Norwegian society by delivering value to society and addressing the grand challenges of our time.

Let us turn to the case for a closer look at how this unfolds.

Vicious circle and catch-22

We could say that the project exemplifies a success story produced by the third generation of Norwegian research funding, given that BEDPAN is currently generously funded by the Council. The funding enables the BEDPAN Team to

explore novel categories of use latent in the material, helping Norway move from an oil-dependent economy to greener bio- and nano-based technology.

Both Digital Life and the Norwegian technology transfer office called *Inven2* help to establish dialogs between the BEDPAN Team and potential partners. Their support is needed. BEDPAN currently only has one committed industry partner, a small-scale company. In line with the general RRI idea of including stakeholders as early as possible, other stakeholders were included from the outset. A kick-off meeting in 2019 managed to gather a handful of potential partners. But a follow-up stakeholder meeting in May 2021 ended up with zero participants. And despite many efforts and Digital Life's expertise and networking, there has been little or (usually) no interest from other potential partners. Nobody wants to be included. Apparently.

The Project Leader describes trying to talk to potential stakeholders as a vicious circle. Instead of building mutual understanding and unfolding the new and emerging technology, the dialog attempts have been stranded.

> We go to companies, and we say we *might* have something here, in the future, but we can develop it better if you tell us what you might need it for. But then, they don't know what it can do yet, right?
>
> It's an endless, vicious cycle of… at the end of the day, a lack of communication, right? These people have some ideas of what they would like to do, and we have some ideas of what these materials might be able to do, but bringing these together, in a room, to brainstorm what we could really achieve has proven very difficult. (Project Leader)

One reason for the lack of communication seems to be that BEDPAN is still in the early phase. According to the PhD Candidate, the companies "know that there are hundreds of thousands of people doing research, perhaps only one percent of them make it through to the last step and have a product." Besides, the companies already *have* established infrastructure to develop the palladium nanoparticles, namely their chemical methods. These methods are suboptimal regarding costs and environmental pollution, but they *work*. And few incentives are in place from the governance side so companies have no desire to change their methods, such as tax reduction for those who change, or fines and increased taxes for those who don't.

Finally, the PhD Candidate also estimates that 35% to 40% of the negative communication has to do with BEDPAN involving *nano*. The potential partners do not really know what nanoparticles can do. Nor do they understand the timeframe of the developmental process, he claims. While the process carried out by BEDPAN can take years, the people at the companies think only months ahead: "They tell us, 'OK, if you need four years, why are you inviting us now? Contact us three months before you have the product'" (PhD Candidate). The problem is that to have a product ready for the stakeholders, the use context is, to some extent, needed. The success of the project is context-dependent (this is the hallmark of Mode 2 research (Scott et al., 2003)).

> In theory, we claim that we can make all the possible shapes and all the possible sizes. That's why we don't know which one to start with to optimize. All the markets are the same for us; we would like to have any of them, but we don't know which one to start with. If you ask this company,

they will say, 'Make those because those are interesting for us.' And if you ask another one, they will tell you the opposite. (PhD Candidate)

With the negative response from the potential partners, we see BEDPAN's first problem as being associated with stakeholder inclusion. While no shortage of initiatives for dialog have been initiated by Digital Life and the BEDPAN Team, the initiatives just have not ignited enthusiasm, engagement and dialog in exploring the production method and the material. Potential stakeholders have not accepted the invitation to co-develop (and co-fund) novel categories potentially embedded in BEDPAN's invention or embraced the fact that it just takes time and money to develop these things properly.

The lack of interest is neither new nor special nor unexpected. As pointed out by Parandian et al. (2012), while new technologies like nanotechnology have been surrounded by big promises for some time already, the vision of a third industrial revolution, environmental remediation and human enhancement, and their open-ended character have also led to a restrained willingness to invest in the projects. "Innovation actors are reluctant to invest in concrete developments because the promises are open-ended, and eventual demand is not articulated" (Parandian et al. 2012: 565). We might call it instrumental thinking: The industries need a clear category of use under which they can consider the potential of the invention. They need to see how the invention fulfils a clear-cut purpose and a functional role within the broader yet specific industrial enterprise. Whatever we call it, however, there is a reason why the step from technological invention to commercialization is often called the Valley of Death. The step from initial discovery to full-scale development is long, uncertain, and undetermined. It depends on many non-scientific circumstances, such as production techniques, scalability, cost-benefit ratios, regulatory compliance, logistics and supply chains, suitable business models, affordability, proper risk management plans, and user and public opinion acceptance.

It is not my business to suggest what the Council should be doing differently in helping BEDPAN reach out to potential stakeholders. As far as I can tell, the help provided by Digital Life and Inven2 is excellent, and the Council *does* support their dedicated interest and support in ways that many researchers probably can only dream of. Nor is it my intention to criticize the companies. My point is only to show that, unfortunately for the BEDPAN Team, the lack of interest from the industries leads to a catch-22. On the one hand, the potential stakeholders do not "need" what BEDPAN offers. On the other hand, BEDPAN needs the company and the purpose of their use context to develop what the potential stakeholders need and would like to see. But stakeholders cannot yet have this because BEDPAN has no product ready.

Instrumentalist thinking in funding scheme

The previous section reported BEDPAN's experiences in their (hitherto) fruitless attempts to communicate with potential stakeholders. The many invitations for dialog are not *just* attempts for each party to hear the other's considerations and be mutually responsive (Von Schomberg, 2011), but critical attempts to bring in money so that the project can outlive four years. This section turns to the Council's funding set-up to further reflect upon the prospects of BEDPAN.

When the four-year Digital Life funding runs out in mid-2023, the BEDPAN Team should, ideally, have reached a technological readiness level prepared for commercialization. The Council is also encouraging the Project Leader to start a company (at significant personal risk, according to the Project leader) with committed business stakeholders. Then, assuming public support will still be necessary (as is highly likely), BEDPAN can apply for grants launched by the Council's programme for applied research, currently entitled *Innovation Project in Business Life* (IPBL) (RCN 2021). In effect, this means that sometime soon,

BEDPAN will be evaluated according to criteria here reproduced as IPBL 1–3 (Table 1):

IPBL 1	**IPBL 2**	**IPBL 3**
To what extent does the innovation help society accomplish the United Nations Sustainable Development Goals or help solve other grand societal challenges?	To what extent does the innovation represent something new?	To what extent does the innovation project target precise needs or market possibilities for the project owner and the collaborators?

Table 1. Selected criteria from the Research Council of Norway (RCN, 2021).

At first glance, IPBL 1–3 look promising for the BEDPAN project. Per IPBL 1, the project harbours favourable aspects related to the United Nations Sustainable Development Goals, with its potential contribution to a cleaner environment and better cancer treatment. Moreover, IPBL 2 explicitly calls for new inventions, which is precisely what the BEDPAN Team is about to develop. However, the promise is apparent. We can see that the benchmarks of "precise needs" and "market possibilities" reflected in IPBL 3 presuppose *something* to sell. They presuppose a determinate object ready to be launched into pre-existing demands. In other words, they presuppose that "needs" and "possibilities" meet in what Geels (2018) describes as the socio-technical landscape wherein the markets and user preferences together define the "window of opportunities" for novel products and niche innovation.

According to what we have experienced, BEDPAN will struggle at IPBL 3. Unless the project *either* has some significant breakthrough within the relatively short timeline of the Digital Life funding (which is unrealistic) *or* gravely oversells its proofs to potential stakeholders (which is unethical and poor scientific behaviour), BEDPAN will not have a determinate object ready by the end of the four years. In other words, unless some intervention rapidly takes BEDPAN out of the vicious cycle before the end of the four years, it will not be easy to deliver according to the benchmark set by IPBL 3. No object would be ready to target this or that market, which does not exist, since the companies do not to date see the point of changing their production methods.

BEDPAN's problem appears to be intrinsic and paradoxical, considering on the one hand that BEDPAN substantially meets IPBL 1 and IPBL 2 criteria. On the other hand, the project does not have a goal in the form of a specific market need (per the standard set by IPBL 3) precisely because BEDPAN can tick off a large portion of newness (per IPBL 2). The paradox, then, is that BEDPAN's open-ended

process will struggle considering the criteria launched by an institution meant to enable business innovation. In this sense, the IPBL program seems to *dis*-appreciate the novel object hypothesized to emerge through the process.

In effect, we can again speak of instrumentalist thinking embedded in the system, this time alongside the public funding institution. The idea of putting money into a project seems neatly tied to the activity of subordinating the emerging technology under the clear-cut category determined in advance. Funding appears to be conditioned by the idea that the outcome of the inventive process should correlate directly to market needs and that both outcome and need find common ground in a specific user object.

The risk of 4E Waste

I have tried to show how the Digital Life grant and the IPBL rely on stakeholders to finance BEDPAN's further achievements. The Council seems to have launched BEDPAN into a predetermined track, hinging on stakeholder inclusion as a silver bullet. Or perhaps better expressed, the Council factors in stakeholders as critical pieces in the socio-technical machinery, progressing steadily toward the market as long as the stakeholders are included. Whatever the metaphor, I would like to investigate other implications of what we have seen, including the real risk of what I introduced as 4E Waste. But first, despite the critical tone of this paper, we will also see that the BEDPAN case reveals a delicate field with no clear-cut rights and wrongs.

On the one hand, we must not forget that the Council did fund BEDPAN at a very early stage. The Council took a calculated risk, putting Norwegian taxpayer money into an idea that might become an object in the future. Various representatives from Norwegian society made a choice based on general utilitarian calculus and the more particular calculus associated with BEDPAN, as described above). For instance, instead of funding a new fMRI machine at a local hospital that could help a specified number of people, the politicians, bureaucrats, and decision-makers involved on various levels chose to put the money into *this* project that *might* help society steer toward an even greater common good.

Maybe the funding even came too early. The Project Leader admits that it has always been somewhat unrealistic to reach the goal of a "super amazing" product by the end of four years of funding.

> We knew this wasn't realistic from the start when we applied. We applied with the promise of some far-fetched long-term goal, and we never promised this would be done within the project's duration. We will be very far from this being directly applicable to some industries. We are just on the way there. We are paving the path. (Project Leader)

Without thereby accusing the Project Leader of misleading anybody, one might say that the application conducted what could be called promissory science. Perhaps the lingo used to sell innovative research projects in Norway gave the impression – almost by necessity – that something indeed *was* within reach within the four years, something that could propel society toward a new, greener and healthier track.

On the other hand, we should not forget that while RRI *did* emerge as a genuine need to regulate the scientific community, research can also imply distinguished human, high-skilled evaluations harbouring the broad horizon of moral life

(Akrivou, 2015; Degryse, 2011; Mejlgaard et al., 2019; Nydal, 2021). That is, at least from a philosophical perspective, research can potentially imply an ethos whose judgments transcend the utilities defined by paying markets. Research can suggest the vision of the larger purpose of the "Good Life," and whatever this means in other regards (explored, for instance, by Swierstra & Waelbers, 2012), *life* just cannot be reduced to means-end relationships. Life embeds self-propelling value, intrinsic purpose, or purposiveness without purpose (Kant, 2000; Weber & Varela, 2002). And indeed, the Council did show trust in this research ethos by funding BEDPAN. It gave the BEDPAN Team a chance to carve out and manifest their view of a better future, accomplishing it through new and emerging technology. The problem is that this funding is not enough. There is no way of getting around the fact that the BEDPAN project exploration *takes time*. In a fundamental sense, the process is not a mechanical series of events but an organic process with its intrinsic pace and timeline. There are limits to how fast things can progress. No silver bullet can alter this fact. The period of four years is simply not enough time to develop what BEDPAN potentially has to offer.

This leads us back to the question of core funding touched upon above. While the Project Leader is grateful for the relatively large Digital Life grant, he also regrets that the Norwegian funding system offers no core funding over a ten-year period and beyond to enable him and fellow experts to develop things properly. "In research groups in general, we need a core group of personnel who can keep some of the knowledge around. This is what's desperately missing to make this more sustainable over the long-term" (Project Leader). In his experience (which he says he shares with many of his colleagues), the absence of core funding usually implies that every fourth year, a funding gap looms that ranges from weeks to months to years. Graduate doctoral students, postdocs, and other specialists working on temporary contracts leave the project in these gap periods. This loss feels like a massive waste of resources.

> Because you can't continue, because there is no immediate money directly as a follow-up, a lot of knowledge gets lost. People leave the group, everything that has been built, all the experimental experience. Everything leaves with the key people that leave.
>
> If there's no guarantee there will be a follow-up grant because of the high risk of not getting it, then the money you have already becomes worthless because you can't follow up on it. Everything you build dissipates – it disappears. (Project Leader)

Now, some factors come into play to nuance this statement. Recall the advantages of the Norwegian funding system regarding a relatively democratic and egalitarian distribution of money among researchers. Even if the BEDPAN Team ends up being dissolved after four years, and graduate students, postdocs and other specialists leave, their accumulated skills may bear fruit in other projects. Finally, even if the Norwegian funding system *were* organized as a core-funding system, there is no guarantee that the BEDPAN Team would be among the chosen ones granted stable funding in a ten-year perspective. Someone else might as well have received all the funding, which would have resulted in the BEDPAN Team never even embarking on their project.

That said, the Project Leader's statement brings home a sad yet inescapable truth: As long as the current funding scheme in Norway continues, there is a real risk that BEDPAN – a project that could potentially deliver value to society and address the grand challenges of our time – ends up as 4E Waste. Economic Waste (money put into the initial project becomes "worthless" because things are not followed up) goes hand in hand with Eidetic Waste (knowledge is lost when the community of practice building the understanding dissipates), Ecological Waste (the polluting production method of palladium nanoparticles will prevail), and Ethical Waste (the enterprise becomes a missed chance to do something good).

Final remarks

It falls outside my mandate and competence to evaluate whether BEDPAN should receive funding beyond the four years or whether Norwegian policymakers should reorganize the Norwegian funding system into a core funding system. Nor do I see any other silver bullets to solve issues arising in the interaction between science and society. What I can say, however, is that the Council's funding portfolio seems to rest on risky ground with its current reliance on stakeholder inclusion. It also seems safe to state that the fact that some projects make it in the Norwegian agora while others don't does not necessarily reflect a justifiable logic wherein the best and most game-changing idea survives and is accomplished. The outcome could also boil down to sheer luck. I have heard the question raised at BEDPAN meetings (my paraphrasing), "Are there any peripheral personal contacts in the BEDPAN Team that we haven't yet tried out? Did anybody go to college with someone now working in a major company?" In other words, the Council's use and reliance on stakeholder inclusion leaves the success criteria up to Fortuna, the goddess of chance.

Let us hope that the good potential that resides in BEDPAN does not end up unused, despite how the situation looks today. The project might end up as something that could have had a lot of positive impacts but whose good potential never reached fruition. And in the centre of the potential near-miss stands the stakeholder inclusion that – gauging by today's prospects – never really took place. The silver bullet misfired and turned into 4E Waste.

Notes

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[2] Of interest here is how the Council's implementation of RRI plays indirectly into BEDPAN's funding conditions. I leave it up to others to discuss the RRI's ethical foundation, e.g., see Gianni, R. (2016). Framework for the Ethical Assessment of RRI. *Responsibility and Freedom: The Ethical Realm of RRI*, *2*, 143-167; Gianni, R., & Goujon, P. (2019). *What are the conditions for the ethical implementation of RRI?* Routledge London, and the RRI literature as such.

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