

Allocating Capital in Decentralised Networks: Mechanisms for the Cosmos Hub

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Abstract: This paper helps allocate shared capital effectively in the Cosmos ecosystem by examining a range of different allocation mechanisms. We identify the core challenges of allocating shared capital – with a focus on knowledge, opportunism and coordination problems. We outline four mechanisms that capital allocation DAOs can use to allocate capital in different contexts: grants, prizes, tenders and in-house production. Each have implications for the transparency and accountability of capital allocation. Our findings help capital allocation DAOs make decisions about how to allocate shared capital across the Cosmos ecosystem.

Keywords: blockchain, decentralisation, polycentricity, blockchain treasury, decentralised systems, delegation, economics of governance, capital allocation, uncertainty, coordination problems, Cosmos Hub

1. Introduction

Decentralised ecosystems such as the Cosmos Hub have been grappling with how to effectively allocate the shared digital assets of their community pool.⁵ To effectively grow, these ecosystems must allocate capital under significant uncertainty and towards objectives that are constantly evolving in response to market and other factors. They must also consider disagreement amongst diverse community members, as well as accountability and coordination. These problems exist in alternative capital allocation bodies (e.g. non-profit foundations), but the challenges are exacerbated in the context of a permissionless, decentralised and open environment. Cosmos will never perfectly allocate shared capital. There will always be tension about what to fund, how to ensure accountability and transparency on the delivery of projects, and the constant threat of opportunistic behaviour. Our aim in this paper is to help address those challenges by suggesting the appropriate mechanisms for capital allocation in different circumstances.

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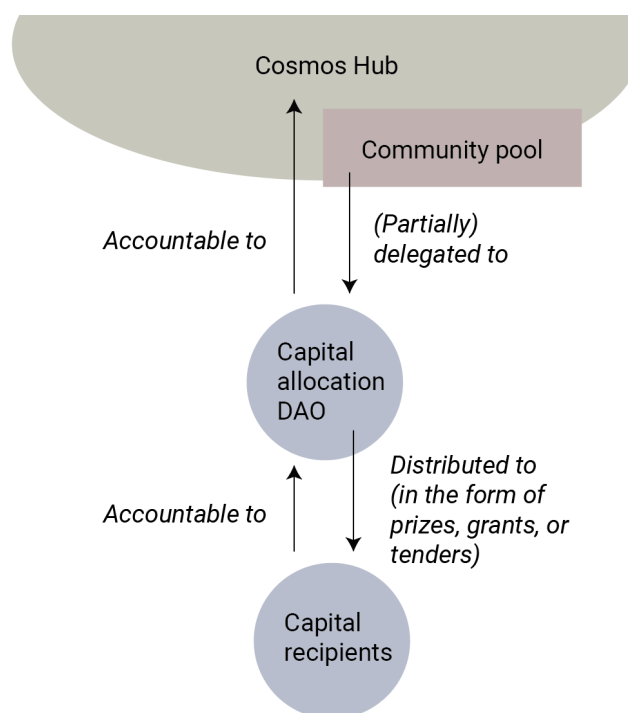
⁵ This paper draws on ideas we first discussed in Allen, DWE and Berg, C (2021) 'A better design for defi grant programs' Cryptoeconomics Australia Medium. Available here: <https://cryptoeconomics-aus.medium.com/a-better-design-for-defi-grant-programs-17b155e83b6f>

and Allen, DWE, Berg, C, Davidson, S, Potts, J (2021) 'Deciding how to spend your blockchain treasury'. Cryptoeconomics Australia Medium. Available here: <https://medium.com/cryptoeconomics-australia/deciding-how-to-spend-your-blockchain-treasury-9021240f7a60>

Our approach is to apply institutional economics and robust political economy theory to the problem of capital allocation. Institutional economics focuses on the role that transactions costs in structuring economic production and exchange, explaining why (for example) centralised firms exist in market economies, the differences between different economic systems, and the role of uncertainty in economic choices. The application of institutional economics to blockchains is what we call *institutional cryptoeconomics*.⁶ We also emphasise a *robust political economy* approach, which seeks to design institutional mechanisms with human fallibility and imperfections in mind.⁷ That is, we need to design and evolve mechanisms knowing that they are imperfect, and that simply applying new mechanisms reveals information about what works.

Because governance is an expansive topic let us begin with some assumptions. Our previous research has demonstrated that there will be many forms of governance across the interchain, such as our recommendation for interchain security level governance bodies for each shared security agreement.⁸ Our focus here is more specifically on the governance of bodies of capital allocation. We refer to these bodies broadly as **capital allocation DAOs**.

Figure 1: Accountability and delegation for capital allocation



Capital allocation DAOs are bodies with some delegated responsibility to allocate shared digital assets for different purposes (e.g. development, maintenance, research, growth). The Cosmos

⁶ Berg, Chris, Sinclair Davidson, and Jason Potts. *Understanding the Blockchain Economy: An Introduction To Institutional Cryptoeconomics*. Edward Elgar Publishing, 2019.

⁷ Pennington, M. (2010). *Robust Political Economy*. Edward Elgar Publishing.

⁸ See Allen, D. W. E, Berg, C., & Davidson, S. (2023). 'The Governance of Cosmos Interchain Security'. Available at SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4638119 Also see the summary here <https://forum.cosmos.network/t/research-the-governance-of-cosmos-interchain-security/12195>

Hub has funded the ATOM Accelerator DAO as a type of capital allocation DAO. There may also be others that will allocate capital for the Cosmos Hub and across the Atom Economic Zone (AEZ). While there is a relationship between any given capital allocation DAO and the broader group of ATOM token holders (we describe this principal agent problem below), our focus is more specifically on the diversity of mechanisms by which a capital allocation DAO might allocate funding (e.g. prizes, tenders, grants programs).

As yet there has been little systematic and rigorous thinking about the precise mechanisms by which pools of shared capital are allocated. The contribution of this paper is to analyse these governance challenges before exploring some of the potential governance mechanism solutions. We draw a parallel to venture finance, where the only major difference is that venture finance is usually for profit whereas grant-giving is for purpose. Grant giving and venture capital both involve entrepreneurial activity – the discovery of new information, new opportunities, and new ideas. At the core of our approach is understanding the precise economic problem that any given capital allocation DAO faces. These challenges include knowledge discovery, coordination problems, consensus building and opportunistic threats. The mechanisms that capital allocation DAOs implement should seek to mitigate the particular structure of problems that the DAO is facing.

The paper is structured as follows. In Section 2 we examine the economic problem of DAO capital allocation. Capital allocation DAOs face knowledge coordination problems, consensus problems, as well as evaluation and transparency of performance. They also face the threat of opportunism, including principal agent problems when governance rights are delegated across organisational boundaries. In Section 3 we turn to four categories of mechanisms by which capital allocation DAOs can allocate funds: grants, prizes, tenders or in-house production. Section 4 concludes the paper.

2. The economic problem of DAO capital allocation

Capital allocation DAOs in the Cosmos ecosystem face persistent economic challenges. Our approach to designing capital allocation DAO institutions is informed by the concept of robust political economy.⁹ This perspective views institutions as robust when they are resilient to uncertainty by fostering local knowledge discovery and encouraging innovation, as well as addressing opportunism through implementing feedback processes, enhancing accountability, and ensuring that incentives are properly aligned. As Mark Pennington describes, “Something is robust if it is able to withstand various stresses and strains. In the context of political and economic institutions, we can define something as being robust if it is able to withstand the stresses and strains wrought by human imperfections.”¹⁰ Robust political economy departs from idealistic assumptions about humans in economic models, rather recognising the inherent fallibility and diverse motivations of individuals involved in DAOs. The design and responsibilities

⁹ Boettke, Peter J, and Peter T Leeson. 2004. “Liberalism, Socialism, and Robust Political Economy.” *Journal of Markets & Morality* 7 (1): 13; Pennington, M. (2010). *Robust Political Economy*. Edward Elgar Publishing.

¹⁰ Pennington, M. (2011, p. 8). Robust political economy. *Policy: A Journal of Public Policy and Ideas*, 27(4), 8-11.

of capital allocation DAOs in Cosmos should be thought of through a similar lens, as they continually try to ameliorate the inevitable costs of uncertainty and opportunism.

2.1. Uncertainty (knowledge discovery)

Capital allocation DAOs face a knowledge problem because they simply do not know what to fund. How can we decide to allocate capital between competing wants?¹¹ While that knowledge problem is persistent, governance structures can aid that decision making process between competing wants. Because information is distributed across the interchain, this hinders the ability to make decisions that are informed and representative of the collective. Decentralisation and pseudonymity also create accountability issues, both in terms of who is responsible for decisions, and who is responsible for outcomes.

The knowledge problem is even more complicated by unclear objectives. While an entrepreneur's decisions are typically driven by the pursuit of profit, the criteria for decision-making within a DAO must align with community-established expectations and objectives. These objectives can encompass a range of goals such as enhancing security, fostering ecosystem growth, promoting community development, and supporting innovative projects. Consequently, the challenges facing a DAO in terms of decision-making can often involve greater levels of uncertainty compared to a traditional profit-seeking entrepreneur, who has the benefit of a singular, clear metric — profit — for recalibration. It is through this lens that we should understand the knowledge discovery problem that mechanisms of capital allocation must solve.

One way the knowledge problem manifests is because of the diverse preferences of people within the Cosmos Hub and the interchain. People have different timelines, experiences, objectives and wealth. This diversity makes decision making consensus hard, particularly in the context of contentious or complex proposals, including those where there are uncertain or longer-term payoffs. Different token holders have opinions on the appropriate time horizon for various funding opportunities. This can give rise to disputes over short-term versus long-term goals. These problems are particularly exacerbated by token holder apathy where low voter participation rates could result in a small subset of token holders making decisions, which may not be representative of the broader community's interests.

Not only do people have different incentives and wants, they also hold different information. There is a long line of literature that describes the importance of local contextual knowledge in decision making. There are two broad lines of research here that are worth noting. Economics Nobel Laureate Friedrich Hayek explained the importance of local knowledge in coordinating economic activity and individual planning, emphasising the marvel of the price mechanism in putting to use diverse local knowledge.¹² Similarly, Economics Nobel Laureate Elinor Ostrom, through her work on commons governance, emphasised how local knowledge is a critical aspect of decentralised governance, examining how communities and groups govern themselves from

¹¹ Even after capital is allocated, and a project is completed, it can be difficult to assess the value of those activities.

¹² Hayek, F. A. (1945). 'The Use of Knowledge in Society'. *American Economic Review* 35(4): 519-530.

the bottom up, rather than through hierarchy.¹³ Compared to hierarchical monocentric systems, polycentric systems that have multiple centres of decision making might better use and adapt around local knowledge.¹⁴

The local nature of knowledge can also create complexity problems in coordinating around a particular task. There are logistic and operational challenges associated with undertaking multiple tasks, initiatives, or projects in a synchronised manner. Unlike traditional organisations where a hierarchical management structure provides management oversight, capital allocation DAOs rely on a distributed network of contributors who have varying levels of involvement, expertise, and interest in the projects being pursued. While on the one hand this might better utilise local contextual knowledge of contributors, it can create coordination problems between those contributors.

Across Cosmos different token holders do not have equal access to information. They may also have different technical expertise to assess capital allocation decisions. Even evaluating the risk associated with new initiatives requires comprehensive due diligence, which may be difficult to conduct in a decentralised setting. Allocating funds to one initiative often means not funding another. Furthermore, fragmented decision making can mean that evaluating the opportunity costs of each decision is difficult -- that is, how could the funds have been alternatively allocated?

2.2. *Opportunism (the principal agent problem)*

Thus far we have assumed that people act in good faith. In reality, however, there is an ever-present risk of opportunism. One of the fundamental constraints on mutually-beneficial exchange is the risk of opportunistic behavior. Oliver Williamson, a Nobel laureate in economics and one of the founders of the institutional economics school, describes opportunism as ‘self-interest-seeking with guile’.¹⁵ This definition recognises that opportunistic behaviour comes from both self-interest seeking — a necessary component of any economic exchange — but also the possibility that such self-interest seeking can involve the use of mechanisms designed to mislead counterparties to that exchange. Governance of the community pool needs to be robust to these opportunistic threats.

The problem of capital allocation in a decentralised context suffers from the problem of opportunism and principal agent problems at many different scales and scopes. In this paper our focus is on capital allocation DAOs who have already been allocated some funds from the community pool (or another source) and delegated some allocation responsibilities. This is not to say all capital allocation DAOs will necessarily act like DAOs, such as through decentralised governance with token holders. It is to say that the community pool itself will not necessarily allocate all capital (we already see this in Cosmos with AADAO), and some of those capital allocations will be allocated by lower-level bodies: capital allocation DAOs. Allocating some

¹³ Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press.

¹⁴ On polycentricity see Aligica, P. D., & Tarko, V. (2012). Polycentricity: from Polanyi to Ostrom, and beyond. *Governance*, 25(2): 237-262.

¹⁵ Williamson, Oliver E. *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*. Free Press, 1985.

spending decisions to other bodies enables some efficiencies from centralisation and expertise, and it might better solve some of those local knowledge and expertise benefits discussed above. At the same time delegation reduces some of the significant cognitive load on ATOM token holders.

Yet capital allocation DAOs generate principal agent problems. Capital allocators can act opportunistically in many ways. Some of those principal agent problems are between the community pool and the capital allocation DAO: the capital allocation DAO could selectively allocate capital to friends or in their own private interests, overstate the effectiveness of the capital they have allocated, or in some other way obfuscate from transparency and accountability around their decisions. At the extreme level capital allocators could act fraudulently and steal funds. At the same time there are also principal agent problems between the capital allocation DAO and recipients of funds from those DAOs. These are similar challenges where both the capital allocation DAO and the recipients can act in their own best interests. Of course agents can also act opportunistically depending on the institutional structure employed. They can act opportunistically by overstating their ability to deliver, or exaggerating their proposal benefits.

Different types of opportunism are possible depending on the powers that are delegated and the structure of governance. For instance, ATOM token holder votes with pseudonymous voters creates a different structure of opportunistic behaviour compared to a closed but known committee that makes decisions while still potentially being vetoed by token holders.¹⁶ The former has greater risks of governance attacks (e.g. Sybil attacks) while the latter raises the possibility of insiders acting fraudulently or in more subtly opportunistic ways, such as through nepotism.

3. A matrix for capital allocation

While uncertainty and opportunism are persistent problems, we are not left helplessly with arbitrary or uniform decision-making. We should seek to design and evolve institutional systems that can make the allocation of funds more robust to human failings. We can think of those institutions as some combination of design, through intentional human action, and also as the result of an emergent ordering of institutions over time (i.e. we discover new institutions through trial and error).

Today shared capital in decentralised ecosystems are largely allocated along a range from closed committees (e.g. a non-profit foundation or centralised committee) or open token holder voting (e.g. proposals to a governance forum, snapshot and voting). The former more centralised option creates a particular structure of costs relating to the private incentives of a small group of decision makers. The latter is a more decentralised option but raises issues of voter fatigue and apathy, a lack of expertise, and threats of malicious votes.¹⁷ While many hybrids exist, it is nonetheless useful to think of capital allocation governance along a spectrum of either agency

¹⁶ On some of the comparative costs of different treasury institutions see Allen, D. W. E., Berg, C., & Lane, A. M. (2021). Trust and Governance in Collective Blockchain Treasuries. Available at SSRN 3891976.

¹⁷ For some of the shortcomings of DAO-based governance see Feichtinger, R., Fritsch, R., Vonlanthen, Y., & Wattenhofer, R. (2023). The Hidden Shortcomings of (D)AOs - An Empirical Study of On-Chain Governance. arXiv preprint 2302.12125.

costs (e.g. principal agent problems with token holders and committee members) or decision costs (e.g. the time and effort of token holders to vote in all proposals).¹⁸

3.1. A capital allocation DAO matrix

In this section we propose a capital allocation DAO matrix that describes a simplified design space for allocation mechanisms. The matrix encompasses two broad problems — knowledge problems and coordination problems — that direct capital allocation DAOs towards different governance mechanisms (grants, prizes, tenders and in-house). The bounds of the matrix should be considered as a simplified but useful spectrum of types of capital allocation problems and solutions, rather than a straightforward choice. Different mechanisms should be deployed for different economic problems, including the different types of uncertainty and coordination problems faced. Effective and robust mechanisms reduce uncertainty by leveraging distributed and specialist information, facilitating comparatively informed decision-making, as well as aligning the incentives between participants within the ecosystem and the overall shared community objectives (however difficult to define).

The first question is whether a capital allocation DAO has a **knowledge problem**. Do you know what problem you're trying to allocate capital to? Do you know what problem you are trying to solve? In some capital allocation DAO situations the DAO will be able to pinpoint relatively precisely what they need, or at least some specific bounds on what they are seeking to allocate capital to to solve a problem. For instance, a protocol fix, specific wallet integration, or marketing spend. Other times the problem is more speculative and ill-defined — the capital allocation DAO simply doesn't know what it needs. This shifts the role of the chosen mechanism in revealing information.

The second question is whether a capital allocation DAO has a **coordination problem**. Do you know how to implement a solution to an identified problem? A capital allocation DAO often faces an entrepreneurial problem in that the DAO doesn't just need to know what to do, but also access to the resources (e.g. labour, expertise), in the necessary order and complementarities, to solve the problem. In some circumstances a capital allocation DAO has a solution to this problem. In other circumstances, they don't know how to solve the problem — including whether you can't identify the problem at all. The more complex and speculative the problem and solution are, the capital allocation DAO can be said to be facing a coordination problem.

Knowledge problems and coordination problems are persistent. Knowledge problems cannot be completely avoided, due to fundamental uncertainty and bounded rationality of actors. Nevertheless, we can categorise some capital allocation problems as facing more or less of a knowledge problem, which shapes the mechanism we use. Coordination problems cannot be completely avoided, in part because of knowledge problems. Nevertheless, we can categorise some capital allocation problems as facing more or less of a coordination problem, which shapes the mechanism we use.

¹⁸ See Allen, D. W. E., Berg, C., & Lane, A. M. (2019). *Cryptodemocracy: How Blockchain can Radically Expand Democratic Choice*. Rowman & Littlefield.

Table 1: Capital allocation framework

	Capital allocation knowledge problem?		
Capital allocation coordination problem?		Yes	No
	Yes	Buy (Prize)	Buy (Tender)
	No	Buy (Grant)	Make (In-house)

This framework recognises that different issues and problems should be addressed using different institutional mechanisms and approaches. A single capital allocation DAO can use a range of different mechanisms based on the structure of knowledge and coordination problems that they face. Whether they use a grant program, announce a prize, or complete the task in-house, are all alternative mechanisms to allocate capital, with different benefits and costs. While the matrix above does not examine opportunism, each of these mechanisms also create threats of principal agent problems and opportunism. Furthermore, how a grant program is evaluated is different from how a tender or prize is evaluated. That is, they not only solve different institutional purposes, but the ways that we build feedback mechanisms into them, and examine their effectiveness, is also different.

In the following sections we extrapolate each of these potential mechanisms, and their economic characteristics. We begin with the more familiar mechanisms (grants, tenders and prizes) which all align more with the idea of allocating capital through buying from others, before turning to the less familiar option of in-house production (making rather than buying).

3.1.1. Grant programs

One option for a capital allocation DAO is to implement one or several grants programs. Grants programs are useful where the DAO has some uncertainty about objectives (i.e. a knowledge problem) but may be able to identify combinations of resources in the community to resolve the issue.

A capital allocation DAO is itself delegated funds from the treasury or community pool, perhaps for a certain period of time. There may be multiple capital allocation DAOs funded by the community pool (or other shared sources of capital) who may each run different types and styles of grant programs. Nevertheless, let us focus on capital allocation DAOs allocating their funding through grant programs. Our aim here is not to get into the fine-grained detail of grant programs, but rather to distinguish them from alternative economic mechanisms of DAO capital allocation.

One key and underappreciated aspect of a grants program is that the process reveals information from the community (through proposals). That includes both new ideas and new talent that may not have been visible through a more closed or top-down approach to allocating capital. There is an underlying assumption here that the decision making processes of the grant program are able to recognise a valuable solution once it is presented to them. It is worthwhile noting that the decision to run a grants program that funds many smaller projects, compared to

one that funds fewer larger projects, is partly a decision about the capacity of the capital allocation DAO decision makers to overcome a knowledge, coordination and opportunism problem.

Typically for a grant program the community is encouraged to submit proposals. The grants program may also have specific themes or varying levels or rounds, tailored to the desired outcomes. An all token holder vote over proposals to the forum has grant-program like characteristics, except the decision makers are a broad subset of token holders, rather than some more specialised committee. There are still different governance problems that exist through capital allocation in a grants program. Using token through token holder voting (e.g. drawing on the collective choice of a broad group of stakeholders) imposes various costs such as the risk of capture (e.g. a governance attack) as well as a lack of expert decision making because of a lack of information. A grant program with a more specific committee (including if that committee is elected) has more control to develop specific themes or varying levels or rounds, tailored to their desired outcomes.

There are several ways that grants programs can deal with the knowledge problem of grant funding. Proposal vetting and collective choice mechanisms are essential to ensure a rigorous process, including to bound spending decisions to a budget. These processes, however, are seeking to solve many different problems. Vetting mechanisms, such as through committees or token holder voting, must decide between different capital allocation options, including considering the opportunity costs of any allocation decision. At the same time these vetting mechanisms are observing and making judgements about the likelihood that a given capital allocation will be effective (e.g. will the proposers deliver). There are mechanisms that grants programs can integrate to overcome some of these knowledge problems, such as using subject-matter experts to consult on the feasibility and progress of grant-based projects.

There are also opportunism and coordination problems that need to be overcome in grants programs. Ensuring that allocated funds are used efficiently and deliver the expected return on investment is a persistent challenge for all organisations. These problems are exacerbated in decentralised contexts by limited oversight mechanisms and a lack of transparency in funded projects. Common approaches beyond vetting or screening mechanisms include milestone-based funding (where funds are disbursed in stages, contingent on milestones).

It's worthwhile noting that many mechanisms seeking to reduce opportunism in grants programs (e.g. milestone-based funding) can impose significant compliance burdens on both the grant giver and grant recipients. Other mechanisms such as some forms of community audits or retrospective voting by the community on the effectiveness of the grant (i.e. drawing on knowledge or sovereignty of the token holders) might simply push the costs from the grant giver to the community, while still imposing compliance burdens on the grant recipients.

Any given capital allocation DAO could implement different grant programs. For instance, different grants program structures could include larger more rigorous centralised committee grant programs, smaller fast grants programs, community voting grants programs. Each of these deal with knowledge, coordination and opportunism problems in different ways. A capital allocation DAO could also allocate funding through a grant program to another grant giving body, as a type of capital allocation subDAO, enabling that subDAO to develop its own unique grants

program. There are significant potential benefits of implementing a diversity of different institutional mechanisms into capital allocation mechanisms, even within the remit of grants programs. In the following sections we turn to alternative mechanisms that may be used alongside grants programs.

3.1.2. Prizes

Rather than using a grants program, which funds activities before they occur, a capital allocation DAO might decide to implement a prize. If the capital allocation DAO has uncertainty both about the solution they are after (i.e. a knowledge problem) and about how to coordinate or identify the resources necessary to achieve it (i.e. a coordination problem), then one strategy is to offer prizes as an incentive for innovative activity within an ecosystem.

There are several ways that prizes differ from grants (and indeed differ tenders and in house production discussed below). Prizes reward activity that has already taken place -- that is, retrospectively. Decisions about awarding prizes happen ex post, after the desired activity has occurred, providing a different type of information revelation. Rather than the decision-making process of a prize happening over uncertainty about the future (e.g. the ability of the grant recipient to deliver, or the value of a project) the decision making centres on the different ways that activities in the community have provided value.

Prizes not only reward behaviour after the fact, they can also tilt capital allocation towards more moonshot activities that would not have otherwise been rewarded. That is, while a capital allocation grant decision making process (where through a committee or some broader token holder vote) might be less likely to fund highly risky projects, prizes can facilitate rewards to higher risk activities by community members. The funding of risky capital allocation through grants can lead to negative token holder reactions, and, depending on the relationship between the capital allocation DAO and the treasury, community pool and community, might not be in the best interests of the DAO. For instance, if a grants program funds a selection of risky projects then none may succeed.

There are a diversity of ways that prizes can be structured. For instance, they can be challenge-based (e.g. to achieve some objective in the most efficient way) to create competitive dynamics between innovative community members. There are various ways that the decision making around prizes can be structured, ranging from committees of experts or delegated capital allocation DAO members, to broader token holder voting.

The focus on funding public and ecosystem goods across blockchain communities has led to different approaches to mechanisms that combine prize-like and grant-like features, such as retroactive public goods funding.¹⁹ Retroactive public goods funding, such as those applied in Optimism in the Ethereum ecosystem, attempt to deal with the intricacies of quantifying success and ensuring integrity and incorruptibility in results evaluation, complexities in technology adoption, and the potential opportunistic attacks on grant programs. They reveal

¹⁹ See, for instance, <https://medium.com/ethereum-optimism/retroactive-public-goods-funding-33c9b7d00f0c>

important lessons in avoiding selective focus on easily achievable objectives, but raise their own issues in evaluation of activities ex post.

3.1.3. Tenders

If the DAO can clearly identify the problem it is trying to solve (no major knowledge problem), but it is uncertain about the specific way to address that problem (including the coordination of resources) then one effective approach is a tender. Tenders provide a structured approach that might help address specific challenges of knowledge, coordination, and opportunism. Tenders elicit detailed information from the community within the bounds defined by the capital allocation DAO. Unlike grants, which may be more open-ended and flexible, tenders typically specify detailed criteria and requirements, ensuring that submissions are closely aligned with the DAO's precise needs.

This detailed and specific nature of tenders helps significantly in mitigating knowledge problems. For a capital allocation DAO to issue a tender it could articulate specific requirements and specifications. This narrows the focus to entities that have the specific expertise and capacity to meet the demands, such as producing a particular product or service. Tenders may elicit broader bidders than a grants process or a price because it does not necessarily require ecosystem-specific knowledge, but rather turns attention to identifying available skilled bidders who can do a specific task.

The formal structure of a tender process differs from grants and prices. Typically, there would be specific criteria against which bidders are assessed, both in terms of price and their capacity to deliver. Rather than generally supporting public goods or new projects in the ecosystem, tenders are far more suited to clearly defined goals, although they enable innovative and efficient solutions to those goals. In some ways the predefined criteria and details of tenders also simplify the evaluation process, making it easier for capital allocation DAOs to compare proposals and select the most suitable ones.

The opportunism risks in the tender process are different to the other mechanisms we've laid out previously. Some of the opportunistic risks get pushed to the tender writing process itself. For instance, a capital allocation DAO could limit competitive applications and direct capital towards some private or pre-decided outcomes. The process of awarding a tender can also be opaque and closed, suffering similar issues of bias and favouritism. On the other hand, clear requirements, along with set evaluation criteria, reduce the scope for subjective decision-making, thereby limiting the potential for opportunistic behavior. Tenders can also implement more contractual safeguards, such as more stringent delivery timelines, which help ensure commitment and accountability from the chosen contractors. Simultaneously the use of a tender can be administratively intense and costly for both the capital allocation DAO and those applying. There is often a considerable investment of time and resources, both in drafting the tender documents and in evaluating the submissions.

When designing a tender a capital allocation DAO should consider a suite of accountability mechanisms. In the first instance they should explicitly define the problem that needs resolving and solicit competitive applications from within and outside the existing community. While less appropriate than the case of a grants program or prize, the DAO might consider innovative accountability mechanisms, such as community token holder voting, even if it is for the initial

selection among tender applications. Alternatively the capital allocation DAO could elect or nominate a specialised committee for the initial selection, decision and monitoring of the tender process. This approach, however, should remain at least partly transparent, perhaps combining with the option of ATOM tokenholders vetoing major funding decisions. There are also alternative approaches that might emerge as the technological infrastructure of Cosmos improves, for instance through staking or slashing by tender applications to ensure incentive alignment.

One of the major costs of the tender process is not simply that it is administratively costly. One major category of cost are those costs stemming from the assumption that the capital allocation DAO has effectively identified and scoped the problem that they need solved. That is, the initial assumption to choose a tender over alternative approaches risks limiting the pool of bidders and projects, who might have adjacent or innovative approaches that don't fit within the specification. This underscores the need to consider tenders as a mechanism alongside a diversity of other mechanisms within a capital allocation DAO.

3.1.4. In-house production

The final option that we outline here is of a different category than the three above: the capital allocation DAO could decide to achieve some task in house. That is, rather than buying the solution by allocating capital to another external organisation (whether through a grant, prize or tender), the capital allocation DAO could use their resources to employ and achieve their objectives through internal hierarchy. There are likely to be some obvious objections to this approach in decentralised communities, but nevertheless we briefly outline this option below.

If the capital allocation DAO has neither a knowledge problem or a coordination problem, then, rather than sourcing the solution from their community or more broadly through a market, it could develop that solution in-house. If the problem is ongoing then hiring a qualified individual and compensating them with a salary could be the optimal approach. One way to think of this approach is that the capital allocation DAO, without a knowledge or a coordination problem, should "just do it" because they have sufficient information and resources to execute a process.

A major concern of in-house production is ex post accountability for spending of collective funds. While in-house production removes several of the opportunistic challenges that arise from buying goods and services through the other mechanisms, it creates other threats. A major and legitimate concern by tokenholder is the opaque syphoning of funds to private interests, without transparent oversight of token holders. There are several potential ways that these costs could be mitigated (although not completely). One option is through continuous reporting and auditing of the capital allocation DAO funds and spending (either internal or by some third party). Token holders could alternatively have some voice into in-house production sending, even if only through periodic voting of whether the capital allocation DAO has met its objectives.

Token holders more broadly can participate in periodic voting to determine whether the capital allocation DAO has met its objectives, including in-house production. Reputation systems generally also play an important role in ensuring accountability for in-house production. We are seeing increasing tooling around tracking the performance and reputation of individuals within DAO structures. We anticipate that these mechanisms, as they continue to improve, will play an important role in coordination around in-house production, and indeed the other mechanisms described above.

Table 2: Summary of mechanisms

Capital Allocation DAO Mechanism	Potential for knowledge discovery	Opportunistic threats	Flexibility to solve capital allocation problems	Administrative complexity
Grants	Encourages broad community input, generating diverse ideas and revealing new talent. Can reveal local knowledge of the community about what problems need to be solved and how.	Potential for capture of grant process from both sides (the capital allocation DAO and proposers). Necessitates vetting and oversight (although this comes with administrative costs)	Highly adaptable to different themes, allowing customisation to meet objectives. Can run multiple grant programs with different scale and scope.	Involves processes for proposal submission and review, requiring moderate administrative effort. There may be significant community demands for further oversight, adding to administrative burdens.
Prizes	Effective for recognizing and rewarding ex post innovation rather than deciding before the fact.	Significantly reduces upfront risks. Opportunism of selecting valuable projects for prizes, and how projects are represented.	Can be structured around specific challenges or broad general prizes. Excludes projects that need funding to achieve impact.	Less administrative complexity and cost.
Tenders	More focused on fulfilling specific, predefined tasks, which may limit broader exploration of ideas.	Structured process reduces but does not eliminate biases and favoritism risks. Major risk of nepotism through the design of tender terms.	Limited in flexibility, focusing primarily on meeting detailed criteria set out in the tender.	Resource-intensive, requiring significant effort in drafting, submission, and evaluation processes.
In-House	Depends largely on internal knowledge and resources, potentially missing external innovative insights.	Increased risk due to potential opaque fund management.	Structured around internal capabilities, offering limited flexibility outside existing resources.	Varies based on task complexity and available internal expertise, ranging from low to high.

A capital allocation DAO could also allocate some standard in-house functions to an operations team. This team would be tasked with undertaking some set of standard or routine expenditure. This approach of course simply add to some of the challenges that we face in other delegation challenges, including both coordination complexity (even though an operations team might

operate under the same mission, aligning their activities with the capital allocation DAO may introduce inefficiencies) and autonomy issues (where we need to strike the balance between autonomy and control, giving the operations team freedom to operate effectively while aligning it to the capital allocation DAO and indeed the community more broadly).

3.2. On Accountability and Transparency of Mechanisms

It is possible to paraphrase and restate Andrei Shleifer and Robert Vishny's definition of corporate governance to blockchain or DAO governance as follows:²⁰

DAO governance involves the mechanisms whereby token-holders ensure they receive a return on their community involvement, either in the form of additional tokens, or utility (somehow defined), or influence. How do token-holders ensure that DAO administrators or smart contracts perform as expected and as intended? How do they protect against the misappropriation of the DAO treasury or the misallocation of funds into underperforming initiatives?

The importance of accountability and transparency in shared capital allocation is well known in the Cosmos community. How can we ensure accountability between capital allocation DAO, the ATOM token holders that fund it, and the recipients of the funds? In this paper we have not tackled this problem directly, but rather focused on a diversity of mechanisms to attempt to allocate funds under uncertainty.

How to effectively create accountability mechanisms is itself experimental. It can and should be determined between each capital allocation DAO and the ATOM community. It depends partly on how the principal (e.g. the ATOM token holder community) views the trade-off between accountability and autonomy of capital allocation DAOs. Nevertheless, many ideas have been floated elsewhere about reporting processes and transparency of spending, including regular or standardised reporting processes. Alternatives include vetoing of particular grants, or time limited allocations of funds to capital allocation DAOs before new proposals are put to the community.

There are two takeaways from our analysis regarding accountability and transparency. First, the capacity to demonstrate accountability (or at least the type of accountability) differs across mechanisms. Take the difference between a small speculative grant program focused on growth initiatives, and a major specific tender process with a known outcome. Accountability reporting in the latter case is far easier. Any attempts to push accountability into capital allocation DAOs should consider this difference amongst mechanisms. One benefit of pushing capital allocation down beyond all token holder votes is to enable smaller organisations — capital allocation DAOs — the autonomy to navigate uncertainty and make discretionary decisions. Because of principal agent problems there should be feedback mechanisms associated with this (e.g. reporting, token holder vetos) but at the same time these mechanisms have the potential to stifle innovative or risky capital allocation endeavours.

²⁰ Adapted from Shleifer, A., and Vishny, R. W. (1997). A survey of corporate governance. *The Journal of Finance*, 52(2), 737-783.

Second, regular reporting periods can be desirable for accountability and transparency purposes. There are many standard things that can be incorporated into these reports (e.g. spending amounts, delivery of milestones, etc). The upshot of our analysis is that at least some of that reporting that the capital allocation DAO does upwards should include how the DAO is assessing the mechanisms they are using in practice. Over time a good capital allocation DAO, to maintain robust and adapt to revealed knowledge, should be shifting the scope of mechanisms they are applying. Including how capital allocation DAOs are thinking about these shifts (e.g. from tenders to prizes, or from grant programs to in house production) is beneficial to demonstrate the self-reflection of the DAO, but also to reveal information to other capital allocation DAOs grappling with similar problems.

4. Conclusion

A major problem facing decentralised ecosystems such as Cosmos is how to allocate shared capital between competing alternatives. Our aim in this paper has been to contribute to this problem by examining different available mechanisms. We have not suggested any single one-size-fits-all mechanism. There is no optimal approach. Rather, we have laid out a diversity of different mechanisms for capital allocation DAOs including grants, prizes, tenders and in-house production. Each of these have distinct advantages and challenges in addressing the inherent problems of knowledge discovery, coordination, and opportunism. They can and should be applied in different combinations within and across different capital allocation DAOs.

The nuances of each capital allocation mechanism demonstrate the necessity for a polycentric approach to governance across the interchain. Polycentric governance in the Cosmos ecosystem implies a multi-layered and complex decision-making framework, where multiple autonomous entities operate under diverse governance models, facilitating robustness and adaptability in capital allocation. This approach, drawing upon the theories of Elinor Ostrom, a Nobel laureate in economic sciences, allows for dynamic, context-specific solutions that address the complexities and uncertainties inherent in decentralized networks. Rather than seeking monocentric governance, with a single uniform mechanism, we should aim towards multiple autonomous decision-making centres, each with their own set of rules and governance mechanisms, coexisting and complementing each other.

Embracing polycentricity in community pool allocation is not merely a theoretical preference but a pragmatic guide to enhancing governance within Cosmos. This model fosters experimentation and innovation in governance practices, adapting over time through trial and error. It allows for greater responsiveness and flexibility, catering to the diverse needs and objectives of community members. The polycentric approach also enhances local engagement — by community members, capital allocation DAOs and capital recipients — giving community members a sense of ownership and empowering them to make more informed and considered choices based on their local conditions.

The Cosmos community should not seek perfection in Cosmos capital allocation institutions, but rather to strive for robustness in those institutions. Cosmos, like all emergent economic and social phenomena, need robust institutions that can withstand the stresses from inevitable human imperfections and the dynamic nature of decentralized ecosystems. The mechanisms outlined in this paper offer a foundation and we hope Cosmos and decentralised ecosystems

broadly will experiment with these mechanisms by trying them in practice, and learning and adapting around them.

Our approach has not looked at the technological frontiers of what is possible. Much could be said about potential mechanisms of governance of capital allocation with improvements in DAO governance tooling and infrastructure. Our view is that there is a significant amount of improvement to be made in capital allocation across decentralised systems by better understanding existing systems of capital allocation, rather than necessarily developing new ones enabled by technology. This is not to say that we are not deeply optimistic about the potential for radically new governance mechanisms enabled by web3.²¹

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²¹ Allen, D. W. E., Berg, C., & Lane, A. M. (2019). *Cryptodemocracy: How Blockchain can Radically Expand Democratic Choice*. Rowman & Littlefield.