ST.GALLEN
SYMPOSIUM

# Global Essay Competition 2025

**Title**: The Global O-Ring Society

**Essay**:

*Introduction*

On a sunny morning in 1986, the space shuttle Challenger lifted off from Kennedy Space Center, carrying seven astronauts on what was meant to be a historic mission. Just 73 seconds after launch, tragedy struck as the shuttle exploded in midair. Investigations later revealed that the disaster was caused by the failure of a small rubber O-ring in one of the shuttle's solid rocket boosters. The cold temperatures that morning had compromised the O-ring's ability to seal properly, allowing hot gases to escape and ultimately leading to the destruction of one of the world's most advanced feats of engineering. All it took to undo billions of dollars of investment and end seven lives was a minor failure in one of the smallest parts of the system.

A decade later, a young economist named Michael Kremer was inspired by this story to write what would become a major work of the development economics literature. He was interested in the stubbornness of economic inequality, wondering why poor countries tend to stay poor. His insight was that some production processes work like space shuttles, in that they rely on all parts of the process working well. Technologically sophisticated processes like the assembly of specialized machinery or cutting-edge R&D work require a series of precise steps in order to work. Countries with lower educational attainment and more instability are at a disadvantage in those processes, and as such investors would refuse to build complex manufacturing and service businesses there (Kremer, 1993). Poor countries could thus never get the investment needed to improve their education systems and institutions, trapping them in poverty.

Six years ago, Michael Kremer won a Nobel Prize for his work. The prize was shared with Esther Duflo and Abhijit Banerjee and, through them, came to be particularly associated with the spectacular success of J-PAL, a poverty research organization the latter two founded. Meanwhile, Kremer's O-ring theory remains in relative obscurity.

*The price of progress is complexity*

Over the last few decades, the world's technological sophistication and global connectedness have progressed rapidly. This has allowed incredible wealth generation, fuelled by economies of specialization and scale. Today, single companies can serve most of the world's needs within their industry at a cost much lower and quality much higher than previously thought possible. This specialization is further driven by digitalization, where individual tasks can be increasingly outsourced to specialist providers, particularly software-as-a-service firms. The coming replacement of service- and knowledge work with artificial intelligence software will only accelerate this trend.

However, this specialization comes with increasing interdependencies. Entire supply chains depend on smooth operations in a dozen countries or more, not even counting threats to shipping routes. Entire industries depend on a complex web of digital service providers, led by cloud services. And entire political systems are shaped by a tempest of ideas, movements, and outrage blowing at breakneck speed across borders.

The study of such interdependent systems is called complexity theory. Alongside the trend of increasing complexity over the last few decades, the field has made large strides understanding how complex systems emerge, how they behave, and how they fail. The centre of this interdisciplinary field can be found in the New Mexico desert at Santa Fe, a thriving offshoot of the research community assembled there eighty years ago to work on the Manhattan Project. In the research since, scientists have found a patterned chaos across both natural complex systems like the wind and social complex systems like the web. In particular, there is a strong pattern of complex systems having outsized responses to small deviations, aggregating to a state of chaos (Thurner, Hanel & Klimek, 2018).

While complex systems have their place, these outsized responses cause problems. A major problem of man-made complex systems in particular is an often underappreciated set of weak-link issues. These systems are designed to bring together many disparate, interacting pieces into a coherent whole. When one part of such a system performs badly, the whole system suffers. This is true in spacecraft as it is in Michael Kremer's O-ring theory. It is also, I will argue, true in the multipolar world and interdependent global economy today. The problems that plagued spaceflight due to its complexity in engineering and that kept countries poor due to a complexity in manufacturing are a precursor to the problems of complexity that our societies and economies face today.

## *The multipolar order as a global O-ring society*

As both businesses and countries depend on increasingly many other businesses and countries, their interdependence multiplies small deviations into O-ring-type threats. This has shown itself in elections altered by media algorithms or in alliance systems suffering from a single disagreements. It can also be seen in multinational businesses facing group-wide losses from local problems, for example in digital platforms fined by the EU, McKinsey losing global reputation due to their role in the US opioid crisis, or Huawei becoming globally sanctioned due to geopolitics. Two of our biggest crises this century similarly started small. The Covid pandemic might have stayed local for far longer in a less interdependent travel system, and the financial crisis was caused by the weakness of one very specific asset class (mortgage-backed securities), which brought down much of the world's financial system, and almost the worldwide economy with it.

When viewed through an O-ring-shaped lens, much of this instability confronting us starts looking more like a natural byproduct of the progress we have made in creating complex systems. The dismantling of global institutions is similarly unsurprising – these are a simple, rules-based systems that cannot deal with the complexity facing them. Instead, complex multilateral problems seem to call for complex multilateral solutions. The mischievous thing about complexity in human systems is that it is often self-reinforcing: Faced with a complex problem, it makes intuitive sense to look for a complex solution. The complexity that results leads to yet greater O-ring problems, which lead to further instability - a reinforcing cycle. Individual actors faced with multipolar threats thus paradoxically make the world more multipolar.

By its nature, complexity resists simple solutions. Any solution to a complex problem has to be somewhat context- and problem-specific. But there is hope: just like chaos holds patterns, so are there patterns in successful responses to chaos. The fact that we have seen O-ring problems before means we can learn how best to respond to a cycle of increasing complexity. To see how, let's return to rockets.

## *Designing second systems*

Luckily, since the Challenger disaster, we have gotten much better at solving technical O-ring problems. The sophistication of rocket science might be out of reach, but I argue that there is a solution from spaceflight that transfers to societal O-ring problems. I will call that solution strategy a "second system". A second system is more than just having an entire duplicate system for redundancy, such as a spare tire on a car. Duplicate redundancy may help with idiosyncratic shocks, but the problems befalling the initial system might just as well take out its duplicate (as an illustration, the Challenger space shuttle did have duplicate O-rings, which both failed due to the cold). It is also more than a simple backup, though it certainly functions as one. The best second systems are already warm when they get activated; they take on a set of day-to-day functions while retaining capabilities to right the ship when and if needed.

The following are a set of best practices for the design of second systems, taken from aerospace engineering and backed by social science research. First, second systems are about shielding. Think of them as containing not just the problems, but any effects of the problem to allow other parts of the system to continue to function. It is rarely the backbone of a system where problems occur, but at its edges; the objective is shielding the technical core (Thompson, 2017). After all, it was not the failed O-ring itself that blew up Challenger, but a resulting collapse of one of its booster tank's internal structure, which caused a course shift, which ultimately exposed the shuttle to aerodynamic forces that tore it apart.

Next, a second system needs to be rigid. One might think that the response to a chaotic world would be a system that is adaptive. That may be true for the main system, which may continuously need to be tinkered with, change, and adapt with the environment. But not all change is good, and when the main system has taken a step in the wrong direction, the second system must be there to catch it. Research has shown conditions under which the correct response to frequent change is stillness (Stieglitz, Knudsen & Becker, 2016). The inertia of the second system ensures that whatever new thing broke the main system will not spread to the second one as well.

A great way to achieve stillness is to have the second system be guided by a mix of simple rules and expertise. These might seem antithetical; why does an expert need simplicity? For achieving stillness, simplicity and expertise are united: They ensure maximum predictability. Research has shown that simple rules are the perfect response to environmental unpredictability (Sull & Eisenhardt, 2015), which is a welcome feature for second systems. An example of this is in allowing pilots to turn off their autopilot (a complex main system) and fly their air- or spacecraft manually, using nothing but their own vision, intuition, and a few simple instruments. The danger of thinking the sophisticated main system would perform better than such a simple second system is illustrated by Boeing's 737 MAX disasters of 2018 and 2019, where an automated system altered pilot input without pilot knowledge, crashing two planes.

Finally, the goal of the second system should not be to perform all functions of the main system, but instead to avert the gravest problems of failure. Not failing is often more important than not succeeding. In aircraft, that might mean focusing on the landing, not the destination. More broadly, it means averting the greatest risks at the cost of minor things going wrong. At times, that might require ejecting the pilot.

## *A call to action*

Throughout history, we have created some institutions that can fulfill the role of a second system in society. Examples of systems ready to provide mutual support include overlapping state and federal governments, independent central banks and political treasuries, faith leaders and political officials, oaths and directives, shadow and actual cabinets, or constitutions and laws. Similarly, businesses may surround their executives with independent boards, powerful legal counsels, and a network of former executives to fall back on. At a time where we need many more second systems, many of these existing systems are relegated in importance. Some of the societal second systems are even under attack today, further worsening the threats of a multipolar complex world.

The new second systems we need do not emerge naturally without attention and effort from decision-makers. Organizations will find it alien to have a separate set of routines with a separate set of norms. New and overlapping systems are antithetical to both those pursuing efficiency and those pursuing simplicity. And by the time a second system is needed, it is often too later to create one. Someone in a position of power with foresight is required to chart the course far in advance. Whether at the level of teams, businesses, countries, or the global society as a whole, we need leaders that take a stance to build and support the second systems of tomorrow.

The future of spaceflight is at times heralded as the solution to get us out of any malaise on Earth. But the ability to bring humanity to distant planets is, still, distant. Until such a time may come, we should instead learn from spaceflight's past. Drawing lessons from the profession's response to O-ring complexity problems can help us overcome similar O-ring issues in today's business and society. While we wait for the future of spaceflight to push us forward, its past proves instructive for staying intact and on course.

**Reference List / Bibliography / Sources**:

Kremer, M. (1993). The O-ring theory of economic development. The quarterly journal of economics, 108(3), 551-575.

Stieglitz, N., Knudsen, T., & Becker, M. C. (2016). Adaptation and inertia in dynamic environments. Strategic Management Journal, 37(9), 1854-1864.

Sull, D. N., & Eisenhardt, K. M. (2015). Simple rules: How to thrive in a complex world. Houghton Mifflin Harcourt.

Thurner, S., Hanel, R., & Klimek, P. (2018). Introduction to the theory of complex systems. Oxford University Press.

Thompson, J. D. (2017). Organizations in action: Social science bases of administrative theory. Routledge.

**Word Count (essay text only)**: (2008/2100)