
The Innovator's Catechism

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ABSTRACT

Innovation teams formed in incubators, research accelerators, hackathon weekends, and within organizations need to quickly align on narrative, workflow, and objectives in order to achieve success. Many of these teams disintegrate or fail to perform due to lack of alignment. Operations orders, such as those in use by the military, have demonstrable impact on organizational efficacy and success. This paper summarizes the history, development, and impact of military operations orders, discusses the history and development of their business counterparts, and presents the “The Innovator’s Catechism”, a catechism-styled operations order for use by early-stage innovation teams. This operations order is built from the “Facilitator’s Catechism”, an operations order for rapidly formed research teams, with acknowledgment for the special information requirements present for emergent and early-stage teams that are market-facing.

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Introduction

An invention is something that is new and potentially useful. An innovation, on the other hand, is an invention where the benefits, financial or otherwise, exceed the costs of developing and executing the idea. A patent is one measure of invention. Around 400,000 patents are granted each year in the United States for ideas that are new, useful, and non-obvious. Sadly, however, 95% of these patents will never be licensed, indicating a systemic failure to create value [1].

Traditionally, invention and innovation have been seen as branches of creativity and therefore resistant to formalization, relying instead on sparks of genius or Eureka moments [2]. Despite this, leaders and entrepreneurs would dearly love to find ways to lower the cost of innovation and prioritize ideas that create the highest value. Innovation management is the study of techniques to bring order to this chaos.

This paper begins with the observation that high reliability organizations (HROs) tend to have the highest level of formalization or structure in terms of carrying out successful projects. HROs include air traffic control, emergency services, space travel, and operating rooms where failure is not an option. The military also has a very structured operational approach that maximizes coordination between subordinate units and minimizes casualties. This approach is known as an operational order or OPORD. The paper starts by considering whether the structure of an OPORD (or similar device) can be used to increase the reliability of innovation management.

A catechism is a set of formal questions set as a test, most commonly, of religious doctrine. In the mid-1970s, DARPA, the Defense Advanced Research Projects Agency, famous for inventions like the internet and GPS, was struggling to bring more structure to its innovation process. The agency introduced a set of questions, known colloquially as the Heilmeier Catechism, to help evaluate and compare research proposals [3].

Cordes and Friedman (2020) have extended the DARPA catechism by overlaying an OPORD structure, which they termed the Facilitator's Catechism [4]. It was always envisaged that the Facilitator's Catechism could be modified for various use cases including innovation management. This paper combines the Facilitator's Catechism approach with Blank's recent discussion on an innovation pipeline to produce a family of innovator catechisms. The result is a series of structured questions that innovators can ask at each stage of the innovation pipeline to improve the reliability and effectiveness of innovation teams.

Operations Orders

Organization in the cooperative pursuit of common aims and objectives is not uniquely human, but the outcomes of the collaborative pursuits of our species certainly are. The successes of human cooperation are due, in part, to the purposeful, iterative refinement of the frameworks, processes, tools, and techniques used to increase the reliability and performance of teams. Productive novelty in problem solving, or innovation, is required to deal with the modern global landscape of challenges. In addition to the digital and internet revolutions, the modern workforce is seeing changes in the fluidity of team membership and the vertical and horizontal scale of team composition, such as increases in bureaucracy, layers of leadership, the number of individuals occupying the same teams or roles, and the number of remote and temporary workers. In these settings, there is an increased emphasis on inter-organization roles, strategies for managing workflow, team communication, and organizational culture. Organizations use evolutionary pressures and continued study and refinement in order to maintain reliable performance [4,5]. Informing this refinement in modern times, is research on industrial and organizational psychology (IO psychology), sensemaking, active inference, narrative construction, entrepreneurship, and high reliability organizations (HROs), each providing their own perspectives to reduce the enigmatic nature of team performance.

The overlapping domains within IO psychology emphasize the psychological and psychometric study of individuals in context with their relationship to their roles and the climate and culture of the organization in order to discover patterns and indicators associated with individual-, team-, and organization-level performance [6,7]. Studies in sensemaking and active inference offer useful insights and frameworks for understanding how teams and their members communicate, parse, and integrate information to update prior models of the world and negotiate meaning to facilitate action [5,8–10]. The various domains that explore the nature and process of narrative construction, such as study of mythology and theology, narrative identity theory, psychoanalysis, and memetics reveal the more difficult to quantify, emotional and intuition driven aspects of team performance, such as esprit de corps [5,11–14]. While IO psychology, sensemaking, and active inference provide nuanced lenses and frameworks for understanding team performance, the study of entrepreneurship and HROs provides meta-analysis of practical case studies to facilitate the identification of the key factors, best practices, and emergent strategies of both individuals and organizations that lead to peak performance and catastrophe [15].

One such emergent strategy, independently discovered by HROs in varied domains, is the development of use-case specific “Operations Orders” (OPORDs) [4]. OPORDs are documents, with specified format, that clearly inform a team or organization of specific intended outcomes to be achieved and the information deemed necessary for the team to achieve these outcomes [16–18]. Use-case specific OPORDs are used in project management and business contexts, however, these OPORDs are subject to the same evolutionary pressure placed on all strategies used in high reliability environments [4]. The modern innovation and entrepreneurship environment, both pre- and post-COVID-19, have new affordances and challenges that require new tools and adaptation of old ones. The experimental OPORD format, “The Facilitator’s Catechism”, is an OPORD variation introduced during the COVID-19 pandemic to help emergent, remote teams maintain reliable performance in the absence of clear leadership, physical meetings, or formal organization [4]. However, this OPORD may be poorly fit to teams such as early-stage start-ups, fully remote innovation teams, and emergent hackathon teams, which have these traits but also the added pressure of communicating information and goals that are market-related. Startup teams (and their stakeholders) are also involved in a collaborative mission that can be viewed as presenting the optimal product to the market, so organizational catechism-style OPORDs for startups need to have additional flexibility to adjust approach and have reduced need to plan for deep intra-team adversarial relationships.

Below, the history and development of OPORDs are summarized and the perspectives offered from studies within the domains of IO psychology, sensemaking, active inference, and narrative construction will be used to discuss the basis for the impact of OPORDs on organizational performance. Then, some aspects of the historical and modern innovation and entrepreneurship environment will be discussed in contexts with the benefits and shortcomings of existing business and project management OPORD-like documents as well as the Facilitator’s Catechism. Finally, a new Facilitator’s Catechism variant, named the “Innovator’s Catechism”, will be introduced with affordances and adaptations that have the potential to impact innovation teams.

Military Operations Orders

Operations orders (OPORDs) are, traditionally, standardized documents that are used by national militaries to facilitate action (see Figure 1) [4,16,18]. Using clear format, compartmentalization, and codified ontology, OPORDs convey expectations of execution and allow organizations to rapidly align on common goals, approach, and

mission-relevant details prior to engaging in military and non-military work [4].

The Israeli OPOD Format	
1. Friendly forces.	(a) Intent or aim of the higher.(b) Unit's mission.(c) Adjacent forces missions.(d) Additional forces missions.1) Engineers.2) Artillery. 3) Direct support.4) General support.
2. Terrain.	(a) General description.(b) Axis.(c) Main obstacles.(d) Trafficability/deployment areas.(e) Key terrain and vital terrain.(f) Summary of effects of terrain on friendly plan.
3. Enemy.	(a) Intentions.(b) Deployment and strength.(c) Most probable course of action.
4. Commander's intention	(when, what, and why).
5. Method.	(a) Scheme of maneuver and fire support.(b) Time phasing and objectives.
6. Forces and tasks.	
7. Combat support	(general).
8. Administrative and logistics	(general).
9. Control.	(a) Location of CP's by stages.(b) Radio procedures.

Figure 1. Israeli OPOD Format as of 1988, adapted from [18]

The earliest historical instances of their usage and refinement are found during the Roman management of an expansive border with frontier territories occupied or bordered by recently conquered and fragmented peoples [4,19,20]. These conditions meant regular and rapidly developing incursions and insurrections, leading the Romans to develop protocol for reallocation of strategic assets and security against material sabotage which came in the form of OPOD variants such as service orders for the delivery of supplies and request of reinforcements and sentry orders for managing access to military camps [4,21,22]. This idea of specialization of OPOD by department or type of mission, will return in a later section on OPODs in businesses. Where sentry orders facilitated explicit process and auditability for reliable physical security of supplies [4], service orders allowed the Roman Army to maintain operational reach despite notable asymmetry between the size and threats of the frontier and the available resources at the Army's disposal [4,19,21]. Emphasizing the importance of these service orders in the Roman Military, there is substantial evidence that Rome's famed road system was not built or used extensively for commercial purposes [21], but instead for maintaining what is referred to in U.S. Military Doctrine as "Economy of Force", or the effective

allocation of military assets and the minimization of the cost of their deployment through well informed logistics [21,23,24].

The next notable developments came in the 19th Century, where the new affordance of inexpensive paper offered European armies the freedom to experiment with new OPORD format and practice while an increased emphasis on standing, professional armies and readiness, military-bureaucracy reforms, and more reliable logistics meant that militaries had the structural changes needed to allow them to mobilize, deploy, and pivot in the field faster, farther, and with less warning than ever before [4,24–31]. The French Armies of the Republic began to develop OPORDs that were many pages long, precisely detailing every action that the unit should perform, however, the mechanical, linear nature of the OPORDs was inconsistent with the nonlinearity of the battlespace, and historical records suggest that these detailed orders were rarely carried out and that the practices surrounding them did not propagate [4,32]. Where the French had long, complicated OPORDs, the Prussians, as a result of their embrace of the philosophy and practice of “Auftragstaktik”, or “Mission-Type Tactics”, developed by Prussian generals von Clausewitz and Griepenkerl and the chief of staff of the Prussian Army, Helmuth von Moltke, saw the emergence of OPORDs that “no longer optimized for detail or technique, but instead for mission, narrative clarity, and minimum time for issuance” [4,18,26].

These OPORDs acknowledged the famed insights of Clausewitz and von Moltke: “war is the realm of uncertainty” [24] and “no plan of operations survives the first collision with the main body of the enemy” [29], respectively. These OPORDs were reflections of the type of field orders von Moltke issued during his campaigns, clearly preferring general directives with guidance rather than strict orders, which earned him criticism but proved effective in the unexpected situations that required increased flexibility [29]. The Prussians believed that the increased fluidity in combat meant that commanders would have to rely on communication of objectives and trust in their officers to act independently in pursuit of those objectives in the field [4,32,33].

The emergence and impact of these formats, and of the underlying military philosophy from which they were developed, inspired a U.S. Cavalry General, Eben Swift, to establish the first instance of a strongly codified “field order” format for OPORDs in 1897 [4,16,32,34]. Swift, who had previously served in the American West fighting the Sioux, Cheyenne, Barrock, and Ute tribes [35–37], in operations that have elements resembling the aforementioned Roman management of frontier territories [4,19,38,39], developed this OPORD format, now

called the “Five Paragraph Order” (5PO), to facilitate the practice of “Auftragstaktik” in the field [4,16,18,32,34]. The 5PO prioritized the provision of the information necessary to “enable the subordinates to carry out the operations [at] hand” [18], and clear communication of the commander’s “intimation of the end” [18]—what it was that the commander wanted to accomplish, rather than how they wanted it accomplished [4,18,32].

The 5PO was just one of many significant contributions made by Swift. In the domain of military pedagogy, Swift introduced the “applicatory method” of instruction at the Army Staff College at Fort Leavenworth, which included “tactical decision games” (TDGs) [40] and regular in-the-field exercises [34,37]. In the domain of operations planning, Swift created the “Military Decision Making Process” (MDMP, see Figure 2) [40,41] which was a novel checklist and process-oriented approach to decision making which could be rendered on a matrix, placing elements of the OPORD in relationship to the progression of the operation, from planning to execution [40]. All of Swift’s notable contributions fit a common theme: adapting the U.S. Military’s Officer Corps to a changing environment, one which favored guerilla tactics, flexibility, and adaptation in response to rapidly changing circumstances, rendering traditional expectations of balance of power obsolete [42–44]. Swift would later take the principles and practices that he formulated and taught at Leavenworth and refine them in the field during WWI and in some of the first notable unconventional conflicts and counterinsurgencies of the 20th Century, such as the Punitive Campaign and the Moro Rebellion [34,35]. The environment that Swift was preparing the U.S. Military for became the norm in the coming decades [44–46]. The 5PO was adopted and adapted by other national governments [4] and use-case specific variants of the OPORD emerged, such as WWI trench-to-trench attack orders [47], or WWII attack, defend, and development orders [18,48].

A tracking of the history of changes to OPORDs indicates that mechanisms, sections, and priorities of their format change in response to new affordances, change in the structural complexity of the organization and its environment, and increases to the fluidity of the battlespace [4,16,26]. Changes to affordances available to militaries may include available infrastructure or equipment such as roads [21] or communications systems [50] but also changes to the mediums available for the issuing and writing OPORDs themselves, such as the availability of “tessera” tablets to the Roman Army [22], the availability of paper for the 19th century armies [4], or digital affordances in modern joint operations [51–53], all of which resulted in new emerging practices related to OPORD format and culture [4]. Changes to OPORD

structural complexity include expanding layers of bureaucracy [45] and introduction of doctrine [54] such as the 19th century Prussian and French military reforms influenced by Carl von Clausewitz and Henri Antoine Jomini [30], joint operations [55,56] such as those between American Expeditionary Forces (AEF), the French Army, and the British Army during World War I [4,45,47,57], and adaptations to physical changes to the battlespace itself such as the introduction of trench and jungle warfare [4,47,58]. Changes to affordances and structural complexity certainly catalyzed OPORD experimentation, however, changes to structural complexity often cause changes to the fluidity of the battlespace, or the freedom with which Centers of Gravity (COGs), the “strategic centers of friendly and adversary strength, power, and resistance” [56,59], in the battlespace may shift, and increased fluidity of Centers of Gravity have provided the evolutionary pressure necessary to encourage the usage and development of new affordances [4].

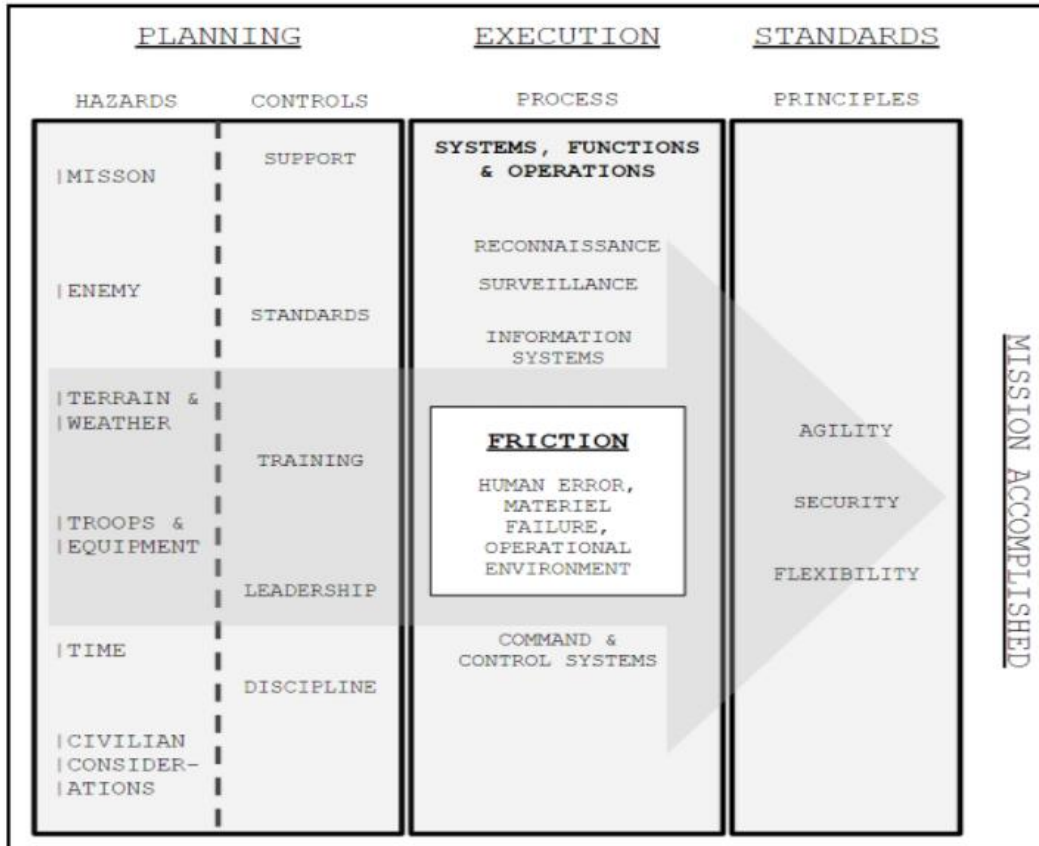


Figure 2. Military Decision Making Process (MDMP) Matrix, adapted from [49]

However, for all the experimentation and the changes that were made to OPORDs in the 20th Century, all “adhered closely” to Swift’s original format (see Figure 3) [16]. Further, virtually all military OPORDs identified by meta-analyses from Fort Leavenworth during

the Cold War appear to cohere to the requirement that the following items be addressed:

1. What the commander issuing the order wanted to accomplish.
2. What limiting or controlling factors must be observed.
3. What resources and support have been allotted. [4,16,18]

		Traditional Field Order	Roman Sentry Order	Swift's 1897 OPORD	US WWI OPORD	US 1940 OPORD	US 8N. Attack OPORD	US BN. Defend OPORD	US Adapted Vietnam OPORD	1988 Soviet OPORD	IDF OPORD	US Modern SPO	Helmeier Catechism	Facilitator's Catechism
Items Included in Format	Mission (0-5)													
	Mission (Desired Outcome)	3	0	3	3	4	4	0	5	5	4	5	5	5
	Milestones for Gauging Success	0	0	0	0	0	0	0	0	0	0	0	5	5
	Purpose of Mission (Impact of Outcome)	0	0	0	0	0	0	0	0	5	0	4	5	5
	Exit Strategy	0	0	0	2	3	1	0	5	1	1	1	0	3
	Affordances (0-5)													
	Situation Details	1	0	4	4	4	4	4	4	4	4	4	5	5
	Logistics Details	0	0	2	5	4	4	4	3	3	3	4	4	2
	Available Operations Support Details	0	0	1	5	3	4	4	2	4	4	4	0	3
	Administrative and Command Details	0	0	4	5	4	4	4	3	4	4	4	0	4
	Communication Instruction (Signal)	1	5	2	5	4	4	4	3	4	3	4	0	4
	Delegation (0-5)													
	Dictates Execution and Method	4	5	2	5	4	4	4	1	2	4	4	5	2
Attributes of Format	Attributes (0-3)													
	Lends Itself to Post-Operation Review	0	3	1	1	1	1	1	1	1	1	2	1	3
	Formalized via Doctrine or Publication	1	2	3	3	3	3	3	0	3	3	3	0	3
	Assumes Organizational Alignment at Issuance	3	3	3	3	3	3	3	3	3	3	3	3	0
	Versioning Compatible	0	0	0	0	0	0	0	0	0	0	2	0	3
	Assumes Team Composition at Issuance	3	2	3	3	3	3	3	3	3	3	3	2	0
REF	Citation	[3]	[9,11]	[3,23]	[3,34]	[4]	[3]	[3]	[3]	[3]	[3]	[1,43]	[98]	n/a
	Appendix section	n/a	n/a	A	C	D	E	F	H	J	I	G	K	L
Comparisons of OPORDs		<div> <div>Items Included in Format</div> <div> <div>0</div>not included <div>1</div>not generally included, not included as part of doctrine <div>2</div>generally included but as subcompartment or unemphasized <div>3</div>generally included <div>4</div>strictly included <div>5</div>strictly included and emphasized </div> </div>												
		<div> <div>Attributes of Format</div> <div> <div>0</div>Format does not have attribute <div>1</div>Format does not lend itself to gaining attribute <div>2</div>Format has attribute to some degree <div>3</div>Clear indication attribute was desired during design </div> </div>												

Figure 3. Comparison of OPORDs [4]

Impact on Organizations

Here we consider the functional features of OPORDs (high reliability, fault tolerance, goal-seeking) in terms of how they are deployed in High Reliability Organizations (HROs) and other complex systems in nature that consist of a massive number of interacting subunits. HROs such as militaries, are organizations that are characterized by their interactions with Complex Threat Surfaces, or threat surfaces which produce non-linear impact if exploited and require non-linear or adaptive defenses [44]. HROs earn their name from maintaining reliable performance and resilience in environments where small errors can create cascading effects and catastrophe [15,60–65]. Given the nature of the environments HROs operate in, there is pressure on these organizations to adapt and develop best practices for handling the myriad of external and internal threats to reliable performance, consequently, they are frequently used as the subject of case studies done in the interest of making these best practices accessible to other organizations [15,60–68]. HROs often converge on the same best practices independently when adapting to environments with similar threats and pressures [15,44], thus it is not coincidence that modern OPORDs appear to cohere to similar standards.

All reflexive systems, at the scale of both organisms and organizations, require ongoing recalibration to survive and thrive. HROs must make these recalibrations consciously [15] and at a rapid pace with limited information in order to update processes and technology to maintain reliable performance [5]. In this cybernetic framing, OPORDs help HROs navigate several interconnected key areas of tradeoff, common to all reflexive systems, to facilitate successful action amidst uncertainty.

Explore-Exploit

“Explore-Exploit” [69,70] refers to the axis of strategic variation related to the adventurousness of the system. Exploratory behavior, or global search, is a broad search through functional and non-functional regimes. Exploitative behavior, or local optimization, is a more narrow search mode based upon the incremental improvement afforded by considering system states close to the current solution. The statistical regularities of the ecosystem and niche are what dictate the success, literally the fitness of a given optimization process [71]. At the scale of the individual, this tradeoff can be anecdotally described as: “sticking with an old favorite ensures a good meal, but if you are willing to explore you might discover

something better” [72]. At the scale of the organization, failing to allow experimentation and ingenuity in order to optimize exploitation based on current understanding of system state will leave operations fragile and stagnant in changing environments [15] whereas allowing too much freedom to explore may result in “misadventure” [4]. Approaches such as cybernetics & active inference seek to finesse the explore-exploit tradeoff space through informed action and experimentation [70,73]. As the dimensionality and ruggedness of the performance landscape increases, deep or generative methods become increasingly important [74]. OPORDs help organizations balance this tradeoff by allowing for rapid alignment on clear goals and situational details, which expedites sensemaking and provides a constraint on exploitation (objective) that acts as a constraint on exploration (situation and approach) [4].

Learn-Perform

Information-processing systems must be able to learn and rapidly adapt their models of the world in response to real time observations, and then reliably perform work and act based on these models. Pedagogical literature informing IO psychologists and educators defines learning as the changes to cognitive structure [75,76], and performance as the measurable outputs of behavior relevant to the system of interest [75,77]. Optimization of the learning processes do not necessarily increase in performance metrics and significant changes in performance do not necessarily create learning outcomes [75], creating a learn-perform trade-off for systems to manage. OPORDs provide constraints for learning in the same fashion that they do for exploration, by providing performance requirements as a constraint on operations, but they also provide opportunities to bridge the gap between learning and performance by providing a tool for post-mortem analysis [4]. If the OPORD clearly defines the goals and performance outcomes, then it can be used in post-operation analysis to inform learning that is tied directly to performance.

Top Down-Bottom Up

Topologically, distributed systems can have a centralized “hub-and-spoke” structure, a small world architecture with both local and global connections, a sparse or dense local connective structure, or other types of patterns. Multiple kinds of descriptors for static and temporal graphs exist, capturing

different aspects of their structure such as the connectedness distribution, PageRank, and semantic similarity [78,79]. Commonly described in graphical settings is a system’s patterns of “top-down” vs. “bottom-up” information processing and decision-making. “Top-down” can refer to information and directives that descend through a managerial hierarchy, or from more abstract areas of cognition into more concrete realizations. “Bottom-up” can refer to systemic changes that are driven by inputs and adjustments from the smallest or most numerous sub-component of a system, for example ant nestmates in the colony or cells in the brain. Collective behavior refers to the properties of interacting system subunits, accounting for the networks of influences that shape group outcomes [80,81]. Collective behavioral systems need to integrate top-down and bottom-up information streams in order to succeed (e.g. not rely too heavily on sensory input nor on preconceptions about the world).

Historically, OPORDs in the military have not provided bottom-up flexibility due to the limited ability to communicate rapidly [4,82]. With the advent of remote and asynchronous communication, OPORDs have emerged in the gray-zone between military and civilian domains that provide some freedom from strict hierarchical control, such as the Heilmeier Catechism—where the parent organization (Defense Advanced Research Projects Agency, DARPA) gives general guidance on a problem and some situational details and the sub-organization (the research team) writes the OPORD and sends it back to the parent organization for approval [4].

The active inference framework deals with how multiscale systems simultaneously enact policy while also updating their internal model of how policy decisions are related to future outcomes [5,83]. Thus active inference reframes and re-navigates some of the tradeoffs mentioned above, such as explore-exploit [73], learn-perform [74,84], and top-down vs. bottom-up [85]. For example, by seeking to experiment in ways that optimally inform the organism, complex long-term policies can be implemented by agents with deep generative models of the world [74]. Active inference emphasizes the role of in-the-loop informative experimentation by system, as guided by their deep generative model. Under active inference, systems act not to maximize their estimated reward at current or future timepoints, but rather engage in sensemaking and policy selection in order to optimally reduce surprising observations in the future—systems that fail to do this (e.g.

systems that are continually surprised about key predictions) will soon cease to exist.

As information-innovation ecosystems worldwide become exponentially more complicated and technical, forming teams require well-designed interventions and scaffoldings. Operation Orders (OPORDs) are one such intervention. This modern increase in operational complexity for startups and other small teams is enabled by access to online and remote collaborators, an affordance that military and non-market-facing organizations have been optimizing for decades. Such organizations use OPORDs to communicate about proposed or mandated projects. Changes in technology are associated with changes in the norms and formats of OPORDs in military contexts [4], and arguably the same relationship between technological advances and logistical innovations exists in the business domain. To highlight domains of function interface between market-facing and non-market-facing operations orders, below we trace the history, educational systems, and uses of the business operation order.

Business Operations Orders

Like any organization, a business needs to coordinate the activities of its various departments to ensure it reaches its desired goals. Most commonly the overarching goal of a commercial enterprise is to maximize shareholder value [86] but business organizations must also consider other aims as well (e.g. as a public-good corporation, hackathon, etc.). One of the earliest examples of detailed orders to a commercial enterprise is the instructions to the Virginia Colony from the Court of King James in 1606 [87]. The instructions accompanied the official charter that established the colony, which was more concerned with the size of the land grant and rights of the stockholders, including issues of governance and inheritance. The instructions themselves included several practical details, such as selecting a site, dealing with inhabitants, and how to explore the country. For instance:

“When you have discovered as far up the river as you mean to plant yourselves, and landed your victuals and munitions; to the end that every man may know his charge, you shall do well to divide your six score men into three parts; whereof one party of them you may appoint to fortifie and build, of which your first work must be your storehouse for victuals; the other you may imploy in preparing your ground and sowing your corn and roots; the other ten of these forty you must leave as centinel at the haven's mouth. The other forty you may imploy for two months in discovery of the river above you, and on the country about you” (para 6)

Unlike later military OPORDS, these instructions were not structured into a standard set of paragraphs. The business world would have to wait until the early 20th century to see some formalization start to arise in its approach to operational instructions.

The first undergraduate degree in business was established at Wharton in 1881, followed later by the MBA program at Harvard in 1908 [88]. The advent of the railroad and telegraph had greatly expanded the size and scope of enterprises leading to the establishment of a managerial class to coordinate operations [89]. Business degrees were created to educate this new elite [90]. By 1920, Harvard had established a required course in business policy in the second year of its MBA program focused on the problems faced by top managers [88]. Senior managers brought examples of problems they were facing to class, with students preparing recommendations, and the managers critiquing the proposals. Students were expected to generalize a set of approaches (or policies) from the examples presented. By 1951, the curriculum had morphed into a set of cases that focused on sizing up a situation, planning a program of action, organizing personnel and putting plans into action, and control/re-appraisal [88,91]. Scholars have attributed this development, in part, to exposure to military planning techniques during the Second World War [90] and there are clear parallels between the textbook process and military OPORDS, as well as between these developments and the development of the OPORD itself.

The 1960s represented a golden age for the strategy industry. Business schools started teaching SWOT analysis, several seminal books on corporate strategy were published, a majority of corporations established strategic planning departments, strategy consulting firms were founded, and computer models were developed to optimize profits [90]. Corporations routinely forecasted financial outcomes up to twenty years into the future. The flaws of this approach were exposed during the oil crises of the early 1970s when oil prices soared along with inflation. Carefully crafted forecasts were thrown into disarray leading to a call to embrace uncertain futures through tools such as scenario planning [92]. Learning and adaptation became more important than predicting the future or creating inflexible plans [93]. Some even advocated eliminating uncertainty by actively seeking to shape the environment [94].

Mintzberg [93] has argued that strategic plans are a form of strategic programming that coordinate the various functions of the organization once a creative strategy (or vision or direction) has been selected. In his view, a staff of planners are structurally incapable of creating novel strategies as they are typically removed from the realities of the day-

to-day business. “Formal procedures will never be able to forecast discontinuities, inform detached managers, or create novel strategies” (p. 111). However, once given a strategic direction, the planner-as-programmer can develop the operational implications of the approach for the organization.

Mintzberg [93] goes on to divide strategic programming into three components, codification, elaboration, and conversion:

Codification means converting a broad vision into operational terms. For instance, a strategy to offer more online offerings lacks specificity for operational managers. Planners can break this down into specific objectives for various units such as growing online sales by 5% per annum or to 30% of total sales within 5 years.

Elaboration means breaking down these objectives into the specific tasks and actions that must be undertaken to realize the objectives. For instance, warehouse space might need to grow to house online inventory. Some parts of the organization must be tasked with growing warehouse capacity and planners can outline the timing and resources required to do so. Elaboration is the task of providing action plans to organizational units and is most analogous to military OPORDS.

Conversion means updating the organization's policies and procedures to reflect the new strategic direction. For instance, an online strategy has implications for payment, shipping, and return policies that might be quite different from the policies in place for brick and mortar operations. Part of making a strategy ‘stick’ is to remove the frictions created by outdated or missing policies for a new situation.

Planning for Startups

Startups, like other kinds of teams, can be formally planned or emerge informally in response to factors such as common threats, interests, and opportunities [5,14,44]. Forming startups are not just learning about a sector or skillset, they are also learning about each other as teammates, and about the team as a collective entity. Ontologies, Narratives, Formal documents, and Tools (ONFT, [5]) can be used as a basis for interventions and as a framework to model the process of team “forming, storming, norming, and performing” [95]. Successful startups are able to blend learning and performing (e.g. during a pivot, sprint, or hackathon/collabothon), suggesting that a valuable domain

of research would be in understanding the interwoven dynamics of team development (learning) and productivity (performance).

The startup community has not been immune to the fashions and fads of planning in the corporate environment. The Small Business Administration (SBA) was created in 1953 with the ability to issue or guarantee loans for small businesses. It is not clear when the SBA first required a business plan to be submitted with a loan application but it seems the practice was widespread by the 1960s [96]. As such, the requirement for a business plan mirrors the growth of formal planning techniques during the 1950s and 1960s. The current Code of Federal Regulations (13 CFR § 120.191) still requires applicants to provide a business plan for an SBA loan (see Appendix A for a business plan outline).

Perhaps in response to this institutional pressure from the SBA, it became fashionable to require a business plan in other startup settings. Venture capitalists emerged in Silicon Valley in the 1960s and started requiring business plans [96]. As entrepreneurship courses started to gain in popularity in the 1980s, the business plan became a central feature of the program with 78% of business schools requiring a business plan as part of their entrepreneurship major by 2004 [97]. Textbooks also emphasized business plans, specialized business plan writing software emerged, and business plan competitions became popular.

Unfortunately, there is very little evidence that having a (good) business plan improves the performance of a startup [97]. Although there is some evidence that a business plan assists in raising external funds, there is virtually no correlation between the quality/quantity of a plan and performance [98]. In fact, entrepreneurs report they rarely review or update their plans once they have been written and the majority of founders on the Inc 500 list of fastest growing companies report spending more time on informal than formal plans [99]. This aligns well with Mintzberg's [93] insight that formal planning may, in fact, hinder strategy making and creativity rather than enhance it.

The growing disenchantment with business plans led to a new movement in the startup community focused around business models rather than business plans. Every military strategist is familiar with von Moltke's famous dictum that "no plan of operations extends with any certainty beyond the first contact with the main hostile force." Steve Blank [100,101] paraphrased the statement for the startup community as "No business plan survives first contact with the customer."

Blank first started teaching customer development at UC Berkeley in Fall 2004, arguing that startups needed to “get out of the building” and test hypotheses about their assumptions with real customers. Blank’s work was amplified by developments in design thinking that encouraged entrepreneurs and innovators to empathize with customers through observation and interaction and then ideate on a range of possible solutions which could then be tested [102].

Eric Ries, a student of Blank, later released *The Lean Startup*, which further popularized the approach by combining customer discovery with agile development principles [103,104]. The lean startup approach encouraged entrepreneurs to create a minimum viable product (MVP) that could generate revenue as fast as possible and then introduce new features over time (rather than the traditional approach of developing a fully-fledged product before launch). Entrepreneurs were encouraged to fail fast and ‘pivot’ away from approaches that were unpopular with customers before they ran out of cash (or ‘runway’).

Around the same time, the first business model canvas was published [105]. A business model canvas replaces a 25-page business plan document with a single page that summarizes the overall plan in a series of categories placed in boxes on the page. The original Business Model Canvas (BMC) divided the page in nine categories: revenue streams, cost structure, value proposition, customer segments, customer relationships, channels, key activities, key partners, and key resources (see Appendix B). Since 2010, a number of other canvases have been proposed including Maurya’s [106] Lean Canvas (see Appendix C). The Lean Canvas adds problem, solution, and unfair advantage to the mix by removing key partners, activities, and resources. In doing so, it challenges the entrepreneur to acknowledge existing solutions and how the startup intends to be better than the competition.

Entrepreneurs are now encouraged by leading entrepreneurship educators to combine a business model canvas with the hypothesis testing approach of Blank [100] and Ries [103] to confirm assumptions in the business model. For instance, an entrepreneur might assume that customers are willing to pay \$10 a month for a streaming subscription service. However, after demonstrating a prototype to a group of target customers, the feedback might suggest that \$5 per month is a more realistic number. Drawing an analogy to science, the entrepreneur’s assumptions are like hypotheses that are tested through carefully-designed experiments and analysis. In science, as in entrepreneurship, experiments should be designed to be informative and actionable, whether the results conform to or challenge prior expectations. Entrepreneurs test the biggest assumptions first then alter the BMC in

response to customer (and other stakeholder) feedback. The iterative approach ensures that entrepreneurs build products that people want and do not waste time building features and products that will flop once they hit the market. As such, Blank [101] describes a startup as “a temporary organization designed to search for a repeatable and scalable business model”. Scaling a company should only occur after a sustainable business model has been validated.

Osterwalder and Blank have also extended the BMC to organizations that do not have revenue, such as government agencies in the defense and intelligence spaces [107]. In this case, revenue is replaced with mission achievement (or impact). Four other tweaks were also made: customer segments are changed to beneficiaries, cost structure is changed to mission cost/budget, channel is changed to deployment, and customer relationships are changed to buy-in/support. The resulting framework was christened the Mission Model Canvas (see Appendix D). The Mission Model Canvas is an example of the productive and bi-directional flow of organizational practices between market-facing and non-market sectors.

The business model canvas enables an entrepreneur to communicate the general thrust of a new venture to a group of stakeholders in a consistent and parsimonious manner. Investors do not have to wade through pages and pages of prose that is often based on very little hard evidence. This frees up time to discuss the general viability of the offering and the assumptions underlying its success. As data is collected and assumptions are updated then the canvas can also be easily modified in real time. Using the canvas to test a set of assumptions also makes everyone in the organization clear on the roadmap from launch to success (or failure).

OPORDS are primarily about coordination. Innovation coordination is more important in a large organization than a startup (which might only comprise one team). However, even in a startup environment, there is still a need to coordinate actions with other stakeholders, particularly investors. The Business Canvas model is not usually prepared for external consumption. Additionally, there can be a tendency to use the Canvas a vision board or incoherent bricolage, rather than a strategic springboard.

Recent Thinking on Innovation Models

Current perspectives on entrepreneurship include several new topics that will be discussed here. Many of these changes to startup logic and practices have arisen due to technological advancement and changes in the innovation/market ecosystem. Fundamentally these approaches are

all approaching startups with a lens of increased early integration and coherence. This need for an “Innovation Stack” was well-justified in a recent work by McKelvey: “The problem with solving one problem is that it usually creates a new problem that requires a new solution with its own new problems. This problem-solution-problem chain continues until eventually one of two things happens: either you fail to solve a problem and die, or you succeed in solving all the problems with a collection of both interlocking and independent innovation. This successful collection is what I call an Innovation Stack” [108].

Recently Blank has promulgated an “Innovation Doctrine”, emphasizing clarity on areas such as context, leadership, innovation pipeline, ambidexterity [109]. Blank’s development from the Business Canvas to the Innovation Doctrine can be seen as a movement upstream in the startup’s causal chain – a movement from scaffolding the semantic content and graphical layout of a 2D artifact, to augmenting the kind of doctrine or policy that a startup might adopt, regardless of their use of a canvas or other tooling.

One integrative project in the space is the DLS Methodology (DLS being derived from combining Design thinking, Lean startup, and Scrum) [110]. Another more holistic modern approach to the startup process is the NABC (Needs, Approach, Benefits relative to cost, and Competition) model [111].

Gray Zone Operations Orders

Today, Instantaneous Remote Teams find themselves in the gray zone between market facing and non-market facing domains. Recent developments to OPORD-like documents have occurred in the gray zone between market-facing and non-market-facing domains. George Heilmeier, while serving as the director of the Defense Advanced Research Projects Agency (DARPA) in the 1970’s, introduced a “catechism” that has acted as a novel form of OPORD for research teams [4]. Catechisms are, traditionally, a set of questions with predefined answers that act as a basis to solidify religious narratives. Heilmeier’s innovation on the catechism was to allow teams to define their own answers to a set of questions related to the research they intended to pursue to generate an OPORD-like document that also acted as a “pre-flight safety checklist” prior to funding. The Heilmeier Catechism format allowed for established teams to distill their mission, situation, and approach in a standardized fashion and then present it to DARPA for approval. Additionally, this format changed the nature of OPORDs by allowing for bidirectional (bottom-up and top-down) informational propagation, by virtue of the call-and-response structure.

The recently introduced Facilitator's Catechism [4] builds on the Heilmeier Catechism in several key dimensions, taking advantage of modern affordances and recognizing contemporary challenges inherent to today's informational ecosystem. Unlike the Heilmeier, the Facilitator's Catechism does not assume fixed team composition or approach at the outset of the project. This flexibility is important for all-online teams, teams with rapidly changing composition, and teams with AI actors. The Facilitator's Catechism introduces the idea of versioning from computer code (e.g. GitHub), which allows the document repository to be a living single source of truth for the project and team. The Facilitator's Catechism can also act as a call for collaborators. The Facilitator's Catechism was written with research- or deliverable-based teams in mind, working in areas that are indirectly market-facing (e.g. grant-funded research). The Heilmeier Catechism introduced a new informational affordance by improving the interface between project funders and proposed research projects. The Facilitator's Catechism builds on this catechism-mediated interfacing of people, projects, and funding with an eye towards unconventional and rapidly formed teams (e.g. during emergencies or hackathons).

The Future of Business OPORDs - What is still needed:

As noted, development in Business OPORDs is oriented towards increasing clarity and success in uncertain or changing contexts. There are several areas, listed here, where current business OPORDs might be made more effective or flexible, drawing from emerging and best practices in HROs, global innovation, and instantaneous online teams.

Notably, there are complementary sets of insights into OPORD design that come from market-facing (business) and non-market-facing (e.g. military) perspective. Across situations and sectors, teams must assess their situation and find successful policies of experimentation, so a variety of practices have converged on asking about the essential features of a team's situation. Figure 4 shows the interfacing of a market-facing OPORD-like document (left side, Lean Canvas) and non-market-facing OPORD (right side, Facilitator's Catechism) via shared areas of focus (center column). This alignability across OPORD formats will return later in the advanced rendering capacities of the Innovator's Catechism.

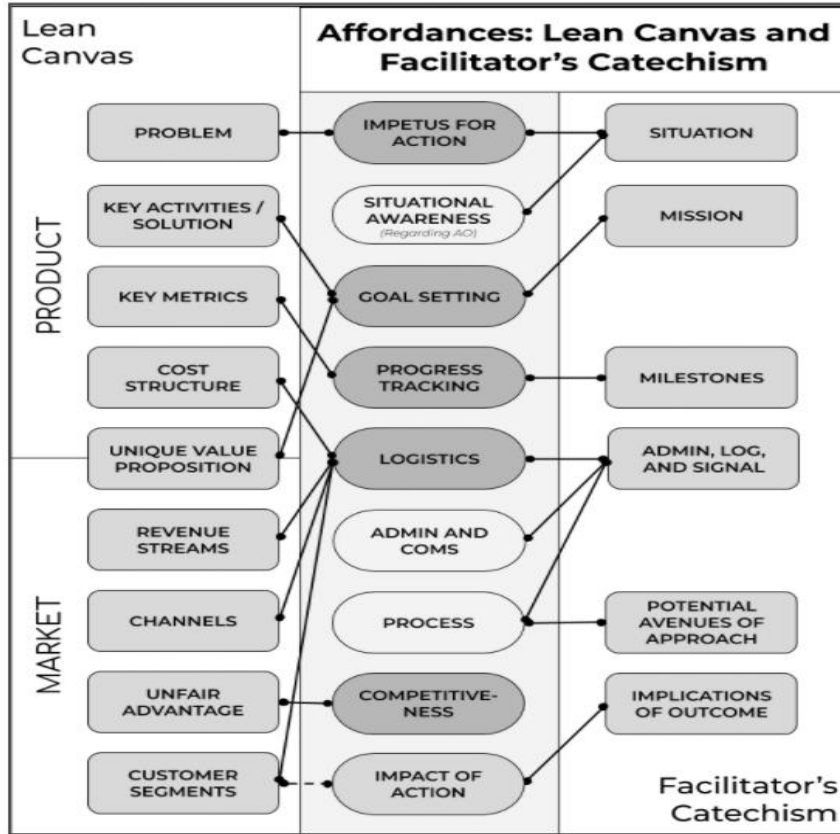


Figure 4. Affordances of the Lean Canvas and Facilitator's Catechism

Currently, organizations are looking across dimensions and sectors to find emerging and successful practices related to innovation, especially in the global and online settings. Small organizations (such as hackathon teams, or startups) are finding value in using computational tools of the kind that larger organizations use as well (e.g. GitHub, CRMs, Cloud services), which facilitates scaling and onboarding. Large organizations of all kinds are looking to small, creative teams within and outside of their ranks (e.g. freelancing, citizen science, working groups) to produce innovation. In the modern entrepreneurship ecosystem, as described above, the trend has been towards increased early-stage systematization, integration across domains and through time, and emphasis on clarity of mission. With all these recent advances in mind, and an eye towards the subsequent introduction of the Innovator's Catechism, we list several areas in which business OPORDs could be further improved:

1. There is no reason that Agile techniques can't be applied to the design and testing phases (not just the build phase). Sprint plans are OPORDs. They are also examples of a time pacing strategy [112]. The pacing and rhythm of business OPORDs is similar to operational tempo in military settings.

2. Versioning systems, usually used to share and annotate code, could help emergent teams build documentation from the beginning of their collaboration,
3. Advanced rendering capacities for reconfigurable visualization could reduce “work about work” by facilitating the rapid preparation of pitch documents, slides, and canvas models.
4. Different renderings (e.g. slides, canvas) of formal documents could be useful to build Rules of Engagement (pre-authorized actions) on hiring, spending etc., maintain values and mission documents.
5. When OPOD frameworks are ill-defined or contain spurious/abstract questions, teams can spend too much time on informal preparation/polishing, and not enough time on the project/development itself.
6. Complexity motivates novel approaches to entrepreneurship [113–115]. emergent startup and the landscape of affordances of different kinds.
7. While “get good feedback & do the most informative experiment” is often given as qualitative advice, this principle is not formally integrated into Business OPOD or presentation formats. This notion of optimal experimentation could be developed using active inference, a multiscale Bayesian framework for action, learning, and development [5,116].

The Innovator’s Catechism

Here we present the “Innovator’s Catechism” (IC). The conception of the IC began with the question: “What would need to be adapted within or added to the Facilitator’s Catechism to make it more useful to early-stage teams in hackathons, working groups, short-term committees, citizen science incubators, and similar groups?” The IC was then constructed by considering both the value offered by the Catechism-styled OPOD, “The Facilitator’s Catechism” [4], to organizations while expanding and improving upon previous approaches to systematic improvement of start-up processes and organizational performance in general to acknowledge the unique requirements and limitations of the early-stage innovation and entrepreneurship teams, allowing for its use to reduce “work-about-work” [117] and increase likelihood of success, especially where:

1. The team will need to rapidly render information about their objectives and approach to a variety of formats to communicate

to external or parent organizations prior to work or in order to secure resources or provide situational awareness at various stages of their development.

2. The information requirements and limitations at different stages of progress vary greatly, creating situations where no single, traditional OPORD would be appropriate at every stage.
3. Team and project success are market-facing (as opposed to the non-market-facing team settings considered by the initial version of the Facilitator's Catechism).

The IC has affinity on several dimensions with OPORDs in the military and high-reliability space, as well as direct mappings to the state-of-the-art practices in entrepreneurship, and uses the same sections as the Facilitator's Catechism: (a) Header, (b) Situation, (c) Mission, (d) Potential Avenues of Approach, (e) Milestones, (f) Administration, Logistics and Signal, and (g) Footer with one exception, as Implications of Outcome has been replaced with Cost and Benefit. However, the IC is unique among OPORDs in that its questions and format are dependent on the team's position in an innovation pipeline, creating what could be considered a "family" of catechisms in which new questions are added and old ones are updated or expanded upon as the team progresses through each stage. At each stage, the questions asked of the team are only the ones that provide the key pieces of information necessary to ensure success and communicate status given the nature of the current objectives and best practices (see Figure 5). For example, at the Ideation stage, a team should not prioritize considering a revenue model, but at the Pitch stage, a team that has not yet considered a revenue model should not be pitching. The information points produced by the questions also serve to align the team, provide constraints to prevent failure, and can be rendered to numerous formats. Below, the Innovator's Catechism is detailed by stage, with Header and Footer discussed separately, as they remain unchanged throughout.

INNOVATOR'S CATECHISM		STAGES		
SECTIONS		IDEATION	CURATION	PITCH ->
	Situation	Key Problems User Segments	Key Problems User Segments	Key Problems User Segments Alternatives Early Adopters
	Mission	Value Proposition	Value Proposition	Value Proposition
	AoA	Approach	Approach Resources	Approach Resources Advantage Feasibility Risks Channels
	Milestones		Milestones	Metrics Milestones
	Cost and Benefit		Cost	Cost Benefits Big Picture
	Admin/log/signal	Person Responsible Contact Stakeholders More Information	Person Responsible Contact Stakeholders More Information	Person Responsible Contact Stakeholders More Information

Figure 5. Information Requirements by Stage

The Header section of the IC is included at the very top of the document, providing a section for key details about the project that should be immediately available to any interested party (Project Name, Team Name, Person(s) Responsible, Contact Information, Start Date, etc.). The Header section of the IC includes key elements from the Facilitator's Catechism but rejects others. For example, due to the nature of an entrepreneurial team and the expectations of continuity, "Date of Completion" and "Call for Collaboration End Date" are removed, as is the recommended "Project Callsign". A Team Name might be the company name, but even if the team is emergent, creating a team name separate from the task at hand provides an anchor for development of organizational culture and "esprit de corps" [5,12,118–120]. The "Date of

Announcement”, which is a more useful wording for the kinds of research projects for which the Facilitator’s Catechism was created for, is rephrased as a more general “Start Date” to provide an initial start date for the current stage as well as give context for expectations of current progress.

The Footer is included at the bottom of each page and it is recommended that it provide the current version of the IC format in use, preferably with a hyperlink to the repository where the version specification is held. In addition, if the document is going to be shared outside the context of a framework that provides versioning details, such as GitHub, it is recommended that the footer also contain a note regarding the current version of the team’s IC with an embedded hyperlink to where other versions are held.

Stages

In the context of the Innovation pipeline [121], we can partition the startup’s journey as occurring through a sequence of stages:

1. Ideation
2. Curation
3. Pitch
4. Exploration
5. Incubation
6. Integration

The pipeline is the representation of the ideal journey from the early-stage recognition of a problem, to the integration of a solution to that problem into the market—or, in the case of non-entrepreneurial innovation teams, integration into the organization. Each stage is represented by its own clear mission, best practices, and information requirements, all of which are meant to lead to outcomes that carry the team to the next stage (see Figure 6).

	IDEATION	CURATION	PITCH	EXPLORATION	INCUBATION	INTEGRATION
MISSION	Create an innovative solution to a problem	Demonstrate novelty and need	Raise Seed Funds, Acquire a budget	Test Assumptions	Create product for use	Place product into production
BEST PRACTICE	Empathizing, Narration, Paper Prototyping, Mind Mapping	Market survey, Competitor Analysis	Canvas, Slide Deck, NABC, Heilmeier Catechism	Hypothesis Testing, Iterative Development of MVP	SRS, Project Plan	AGILE, SCRUM, Licensing, Alliance, Acquisition
OUTCOME	Promising Idea(s)	Compelling use-case(s)	Communication of need and potential for ROI, Acquire Resources	Validated business model or model of potential impact	Clear plan to place product into production	Production

Figure 6. *Innovation Pipeline Matrix*

Ideation Stage

At the Ideation Stage, a group has formed around the acknowledgement of a common problem. Regardless of context, the mission is simple: generate a potential innovative solution to this problem. In order to do this successfully, they must clearly define the problem and who it affects, as well as choose an approach with constraints in order to increase the likelihood of success. Approaches revolve around deep questioning related to the problem through methods such as empathizing and narration, placing the team in the shoes of the users, as well as mind and flow mapping, allowing the team to make the problem observable. The IC at this stage asks few questions, only what is necessary to begin Ideation and inform potentially interested parties as to what is being pursued, who is responsible for the project, who the stakeholders are, and how to contact the team (see Figure 7).

Curation Stage

The team enters the Curation Stage after it has successfully defined a problem, identified the groups of people it affects, and converged on a potential innovative solution. The mission is now to demonstrate the novelty of and need for this solution. At this stage, best practices include approaches like market research and surveys, competitor analysis, and use-case development, consequently, this stage has more information requirements than ideation. Prior to engaging in work, it's important that the team understand the potential costs for the approaches they choose, such as purchasing research tools or commercial intelligence products, and decide on clear milestones to prevent mission or scope creep. The Catechism now adds additional questions and asks for updates to those previously answered, as during this process the definition of the problem or the groups it may affect

may have changed. Given that the approaches now become more complex and may take longer periods of time to achieve, the IC now asks for the key milestones that best indicate progress. For these same reasons and the potential for approaches that require a budget, the IC also asks for what resources may be necessary to commit to this work and the expected costs.

Pitch Stage

At the Pitch stage, the team is now mature enough to define the mission that will carry it through the remaining stages: providing the value of the solution they developed during the Ideation stage and demonstrated the novelty and need for in the Curation stage, consequently, its primary objective is now to communicate this mission and acquire the resources necessary to pursue it. The team now needs to prepare to present its intents to external parties, in a collaborative setting (e.g. hackathon, incubator, or startup-weekend) the team may need to present their potential project to judges or the community, innovation teams within organizations will need to get support and a budget to continue, and start-ups have to acquire funding. This is a stage that any team may need to return to again and again on their journey toward successful integration.

The information requirements at this stage grow rapidly, and the IC now includes all questions (see Figure 7). In addition to all of the questions the IC asks in prior stages, the team must use what it has learned from the Curation stage to define the alternative solutions available, as well as the potential early adopters and the channels over which they will be reached. The team must also define the approach to their evolved mission, the provision of the solution they envisioned, rather than the approach to acquiring funding—to this end, they are asked to define the advantages and risks offered by the approach and the feasibility of success. In addition to milestones, they are now also asked for the metrics that would help measure impact of their solution and the success of the mission. The team now needs to update costs to include the costs associated with the provision of the solution (e.g. cost per user) and add the benefits the provision of the solution might provide (e.g. revenue, cost reduction). Finally, they are now also asked to provide the big picture, if the team were successful and the solution impactful, what would this mean? (e.g. an Airbnb for events, a YouTube specifically for cooking, this privacy solution for Government employees could also be useful in civilian markets).

SITUATION	1	What are the key problems the group has been formed to address?	→ Key Problems
	2	Who is affected by these problems?	→ User Segments
	3	What alternative solutions already exist? Why are they inadequate?	→ Alternatives
	4	Who is actively looking for a competitive edge in handling these problems, most affected by the inadequacies of the available alternatives, and flexible in adopting new solutions?	→ Early Adopters
MISSION	5	Given the situation, in clear terms with no jargon, what is your objective? What value do you aim to provide?	→ Value Proposition
POTENTIAL AVENUES OF APPROACH	6	Given the situation and mission, what are the potential avenues of approach?	→ Approach
	7	What resources are required? Which do you need? Which do you already have?	→ Resources
	8	What unique advantage is offered?	→ Advantage
	9	What are the risks?	→ Risks
	10	Given the advantages offered and the risks present, what is the feasibility? Why is this project likely to succeed?	→ Feasibility
	11	What channels will be used to introduce users to the value you intend to provide?	→ Channels
MILESTONES	12	What metrics can be used to track success and measure impact?	→ Metrics
	13	What are the milestones that best indicate progression toward success? When are they expected to be completed by?	→ Milestones
COST & BENEFITS	14	What are the costs associated with providing the intended value?	→ Costs
	15	What are the benefits of providing the intended value?	→ Benefits
	16	If successful, what else is possible?	→ Big Picture
ADMIN, LOG, & SIGNAL	17	Who is responsible for the project?	→ Person Responsible
	18	How should someone contact you?	→ Contact
	19	Who are the current stakeholders in the groups success? Is there a parent organization? Are there sponsors or investors?	→ Stakeholders
	20	Are there any documents, webpages, or repositories that provide more information about the project?	→ More Information

Figure 7. All Questions of The Innovator's Catechism

The IC has the potential to offer a great deal of value to teams at this stage, contributing to informal and formal pitches in several ways. First, the IC can be rapidly rendered to the large variety of formats (e.g. canvas variants, Heilmeier Catechism, NABC) asked for by different organizations and the team may need to present to a large variety of organizations (see Figures 8 and 9, and Appendices E and F). Second, it allows the team to maintain fully-documented traces of their development as ICs' are versioned at different stages and filled out entering new stages, allowing the team to inform any presentations they create with a story. Third, it can act as a presentation document itself, as a stand-alone brief. Fourth, building on these other value-adds, it can be used to quickly create slide decks that include any of the helpful

formats or use the questions as the narrative structure for their slides (see Appendix G). Lastly, it can be used to generate a straight-forward elevator pitch, brief, or abstract that communicates a straightforward narrative:

*“These **problems** are being experienced by these **users**, and these **alternatives** aren’t adequately addressing their needs. Our **mission** is to provide this **value** to these **users** using this **approach** that (we have this **advantage** in providing)/(provides this **advantage**). It is **feasible** that we will succeed using this **approach** for these **reasons**, despite these **costs**, and these **risks**. Necessary to pursuing this **mission** are these **resources**, of which we still require: [needed **resources**]. Using this approach this group would likely be **early adopters** and we’d introduce them to the value we’re providing using these **channels**. These **metrics** would be used to monitor the impact and these **milestones** would best indicate progress. These are the **stakeholders**. This **person is responsible** for the project. This is how you **contact the team**. **More information** is available here.”*

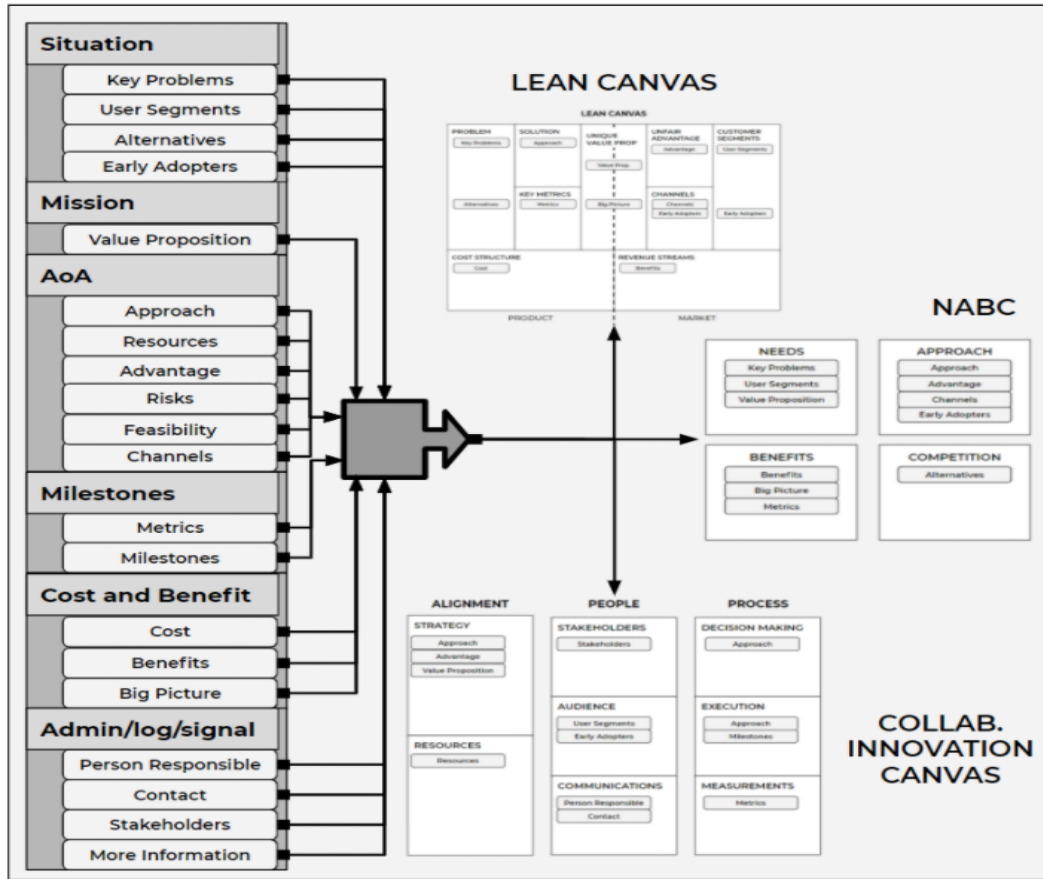


Figure 8. IC Rendering to Various Formats

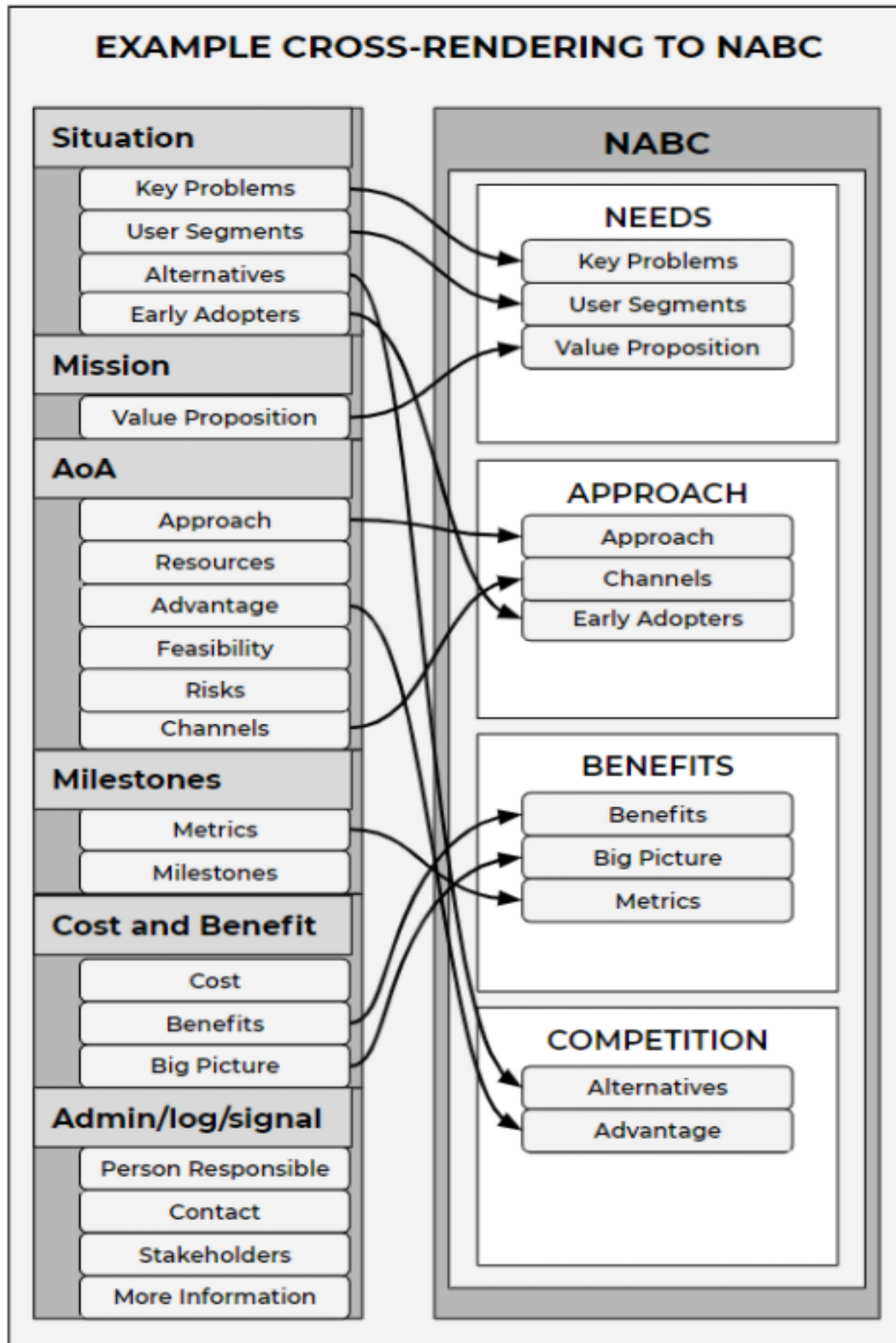


Figure 9. *Innovator's Catechism Example Rendering to NABC*

After the Pitch: Exploration, Incubation, and Integration Stages

The IC beyond the pitch adds no new questions or changes to format. Teams that have succeeded in progressing beyond the pitch will likely have to return it often and are now mature enough to exercise maximum freedom of choice. The “missions” of each stage beyond the pitch can now be reflected in the IC as milestones in pursuit of their larger mission. The team can now optimize function and update the IC accordingly so that when the next opportunity or requirement to return to the Pitch stage arises, they can rapidly communicate their current position, track record, and all other relevant information in the format required while reducing work-about-work—allowing them to focus on the mission itself.

Discussion

In this paper, we have reviewed the history, development, and impact of Operations Orders (ORORDs) in the context of state militaries, high-reliability organizations, and entrepreneurship and presented a modified Facilitators Catechism [4] that is specialized for early-stage innovation teams: The Innovator's Catechism (IC).

The IC has several features that distinguish it from alternative approaches for facilitating development in early-stage startups:

1. **Catechism Format.** Without clarity of mission, approach, and needs, an early startup may bear an unneeded risk of failure. The document ensures that the team has a clear single source of truth to align on and the questions lend themselves to prompting group discussion that has clear deliverables. The Question-and-Answer format of the Catechism also reduces the need for the supplementary material to ensure that it is being filled out correctly.
2. **Narrative Development.** The structure of the family of Innovator's Catechisms (see Figure 7) allows the team and external parties to consider the relevant dimensions of a business approach in the context of a developing narrative. In addition, stage-formalization with clear information requirements for progression clearly marks progress, giving the team a compressible and easily communicated history.
3. **Versioning.** Versioning helps the team have a history and identity. It can help when later assigning ownership, assessing reproducibility, and performing statistical analysis of team

performance across settings. Versioning with a common format allows evaluation of team performance and development through time.

4. **Modularity.** The digital and structured input IC also allows for fluid reformatting into multiple formats (see Figures 8 and 9). This fluid reformatting allows for the rapid production of customizable presentations in a variety of formats such as canvases and slide decks (see Appendices E, F, and G) as well as to the Heilmeier and Facilitator’s Catechism formats. This modular format also enables clear comparability between teams using the IC and between the team’s expectations and later performance—offering clarity in post-mortem analysis.

These features of the IC, among others, have the potential to increase the efficacy of early-stage innovation teams by allowing the team to quickly communicate its ideas both internally and externally and focus on performance and process. The IC acts as the “pre-flight safety checklist” that Heilmeier prescribed, increasing the likelihood of success while also increasing the speed at which teams that are unlikely to succeed disintegrate by forcing them to reckon with the information requirements commensurate with their current stage of development [4]. The IC specification presented (Appendices H, I, and J) will be hosted using a GitHub repository to allow for new variants to be tracked and versioned under a flexible license. It is recommended that the IC be used in hackathons, research accelerators, incubators, and other innovation related events and initiatives to greatly increase the observability, comparability, and likelihood of success of the work being performed. The design space of approaches for catalyzing healthy, productive, innovative online teams is vast, and the Innovator’s Catechism is a first attempt at a catechism-styled OPORD specific to use-cases in this area.

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Appendices

Appendix A. Business Plan Outline [122]

Executive Summary
Business Description & Vision
Definition of the Market
Description of Products and Services
Organization & Management
Marketing and Sales Strategy
Financial Management

Appendix B. Business Model Canvas [123]

File available at <https://www.strategyzer.com/canvas/business-model-canvas>

The Business Model Canvas		Designed for:	Designed by:	Date:	Version:
Key Partners Who are our key partners? What do we co-create? What are the benefits to our partners? What are the risks to our partners? What are the costs to our partners?	Key Activities What key activities do we perform to create value? What key resources do we need to perform these activities? What key channels do we use to reach our customers? What key cost structures do we have?	Value Propositions What value do we deliver to the customer? What value do our customers perceive we are creating? What value do our customers perceive we are delivering? What value do our customers perceive we are capturing?	Customer Relationships What type of relationship does each of our customer segments expect? What type of relationship does each of our customer segments expect? What type of relationship does each of our customer segments expect?	Customer Segments Who are our target customers? What are their needs? What are their pain points? What are their goals?	
Key Resources What key resources do we need to create value? What key resources do we need to perform these activities? What key resources do we need to reach our customers? What key resources do we need to capture value?	Channels How do we reach our customers? What are the benefits to our customers? What are the risks to our customers? What are the costs to our customers?	Cost Structure What are the most important costs incurred in our business model? What are the benefits to our customers? What are the risks to our customers? What are the costs to our customers?	Revenue Streams How do we capture value? What are the benefits to our customers? What are the risks to our customers? What are the costs to our customers?		

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Appendix C. Lean Canvas [124]

File available at <https://leanstack.com/leancanvas>

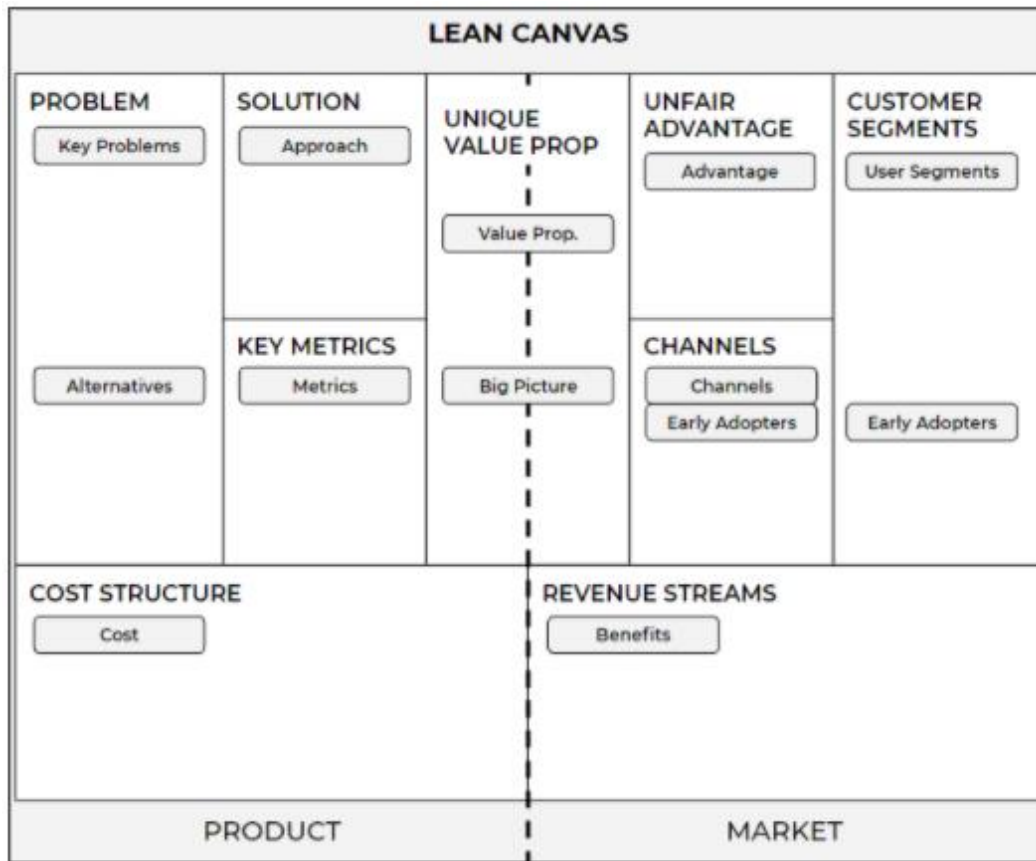
PROBLEM <i>List your top 3-5 problems.</i>	SOLUTION <i>Outline a possible solution for each problem.</i>	UNIQUE VALUE PROPOSITION <i>Single, clear, compelling message that states why you are different and worth paying attention.</i>	UNFAIR ADVANTAGE <i>Something that cannot easily be bought or copied.</i>	CUSTOMER SEGMENTS <i>List your target customers and users.</i>
	KEY METRICS <i>List the key numbers that tell you how your business is doing.</i>		CHANNELS <i>List your paths to customers (direct or indirect).</i>	
EXISTING ALTERNATIVES <i>List how these problems are solved today.</i>		HIGH-LEVEL CONCEPT <i>List your X for Y analogy e.g. YouTube = Flickr for videos.</i>		EARLY ADOPTERS <i>List the characteristics of your ideal customers.</i>
COST STRUCTURE <i>List your fixed and variable costs.</i>			REVENUE STREAMS <i>List your sources of revenue.</i>	

Appendix D. Mission Model Canvas [125]

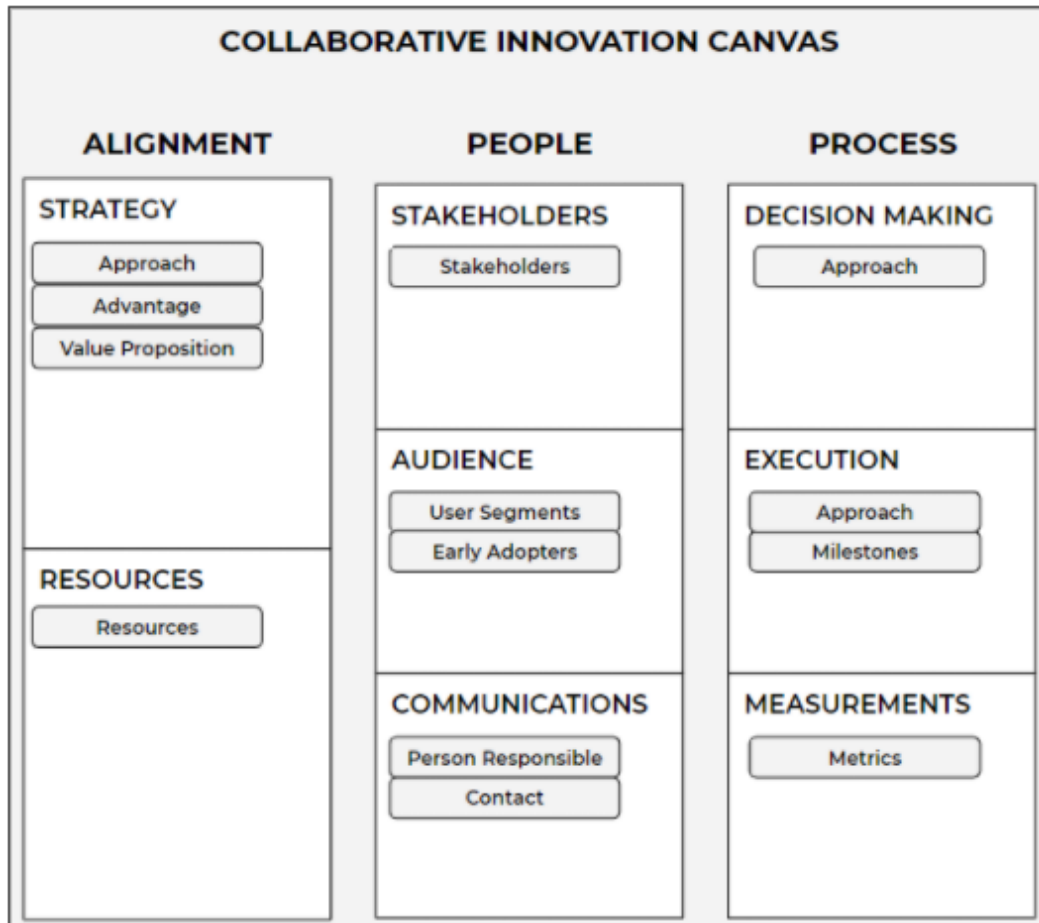
File available at <https://www.strategyzer.com/blog/posts/2016/2/24/the-mission-model-canvas-an-adapted-business-model-canvas-for-mission-driven-organizations>

The Mission Model Canvas					Mission/Problem Description:	Designed by:	Date:	Version:
Key Partners	Key Activities	Value Propositions	Buy-in & Support	Beneficiaries				
	Key Resources		Deployment					
Mission Budget/Cost		Mission Achievement/Impact Factors						
<small> This work is licensed under the Creative Commons Attribution-ShareAlike 4.0 International License. To view a copy of this license, visit http://creativecommons.org/licenses/by-sa/4.0/. DESIGNED BY: Strategyzer AG & Steve Blank The masters of Business Model Generation and Strategyzer</small>					 strategyzer.com			

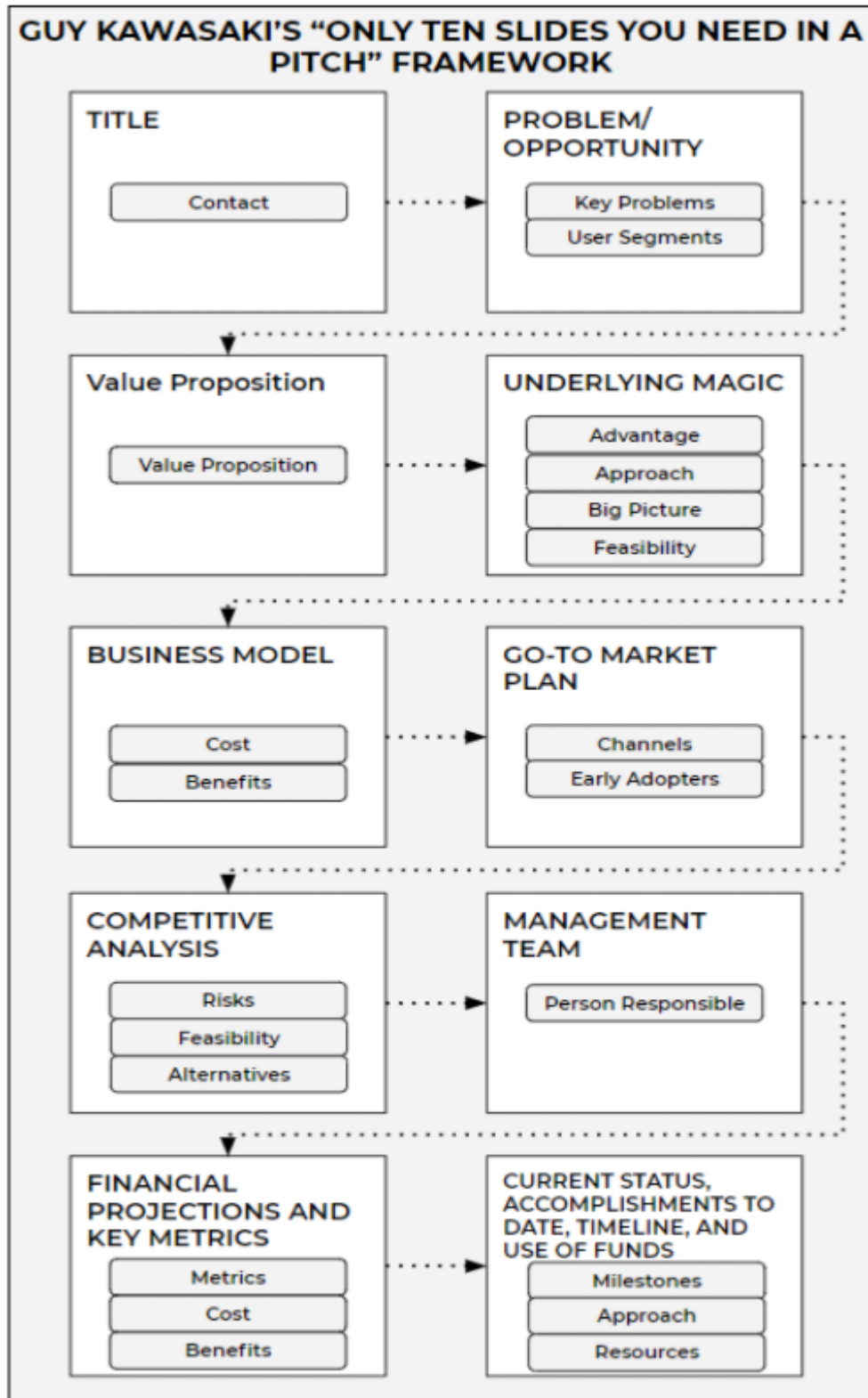
Appendix E. IC to Lean Canvas Rendering adapted from [124]



Appendix F. IC to Collaborative Innovation Canvas Rendering adapted from [126]



Appendix G. IC to Kawasaki's "Only Ten Slides" Framework adapted from [127]



Appendix H. Innovator's Catechism - Ideation

File available at <https://github.com/COGSEC/InnovatorsCatechism>

Full Title of Project

Team Name	x
[person responsible title (e.g. facilitator)]	x
Contact Information	x
Start Date	mm-dd-yyyy

Situation

Key Problems. What are the key problems the group has been formed to address?

User Segments. Who is affected by these problems?

Mission

Value Proposition. Given the situation, in clear terms, with no jargon, what is your objective? What value do you aim to provide?

To create an innovative solution to a problem.

Potential Avenues of Approach

Approach. Given the situation and mission, what are the potential avenues of approach?

Administration, Logistics, and Communications

Person Responsible. Who is responsible for the project?

Contact Information. How should someone contact you?

Stakeholders. Who are the current stakeholders in the groups success? Is there a parent organization? Are there sponsors or investors?

More Information. Are there any documents, webpages, or repositories that provide more information about the project?

Innovator's Catechism - Ideation v1.0

Appendix I. Innovator's Catechism - Curation

File available at <https://github.com/COGSEC/InnovatorsCatechism>

Full Title of Project

Team Name	x
[person responsible title (e.g. facilitator)]	x
Contact Information	x
Start Date	mm-dd-yyyy

Situation

Key Problems. What are the key problems the group has been formed to address?

User Segments. Who is affected by these problems?

Mission

Value Proposition. Given the situation, in clear terms, with no jargon, what is your objective? What value do you aim to provide?

Demonstrate novelty and need of solution.

Potential Avenues of Approach

Approach. Given the situation and mission, what are the potential avenues of approach?

Resources. What resources are required? Which do you need? Which do you already have?

Milestones

Milestones. What are the milestones that best indicate progression toward success? When are they expected to be completed by?

Cost and Benefit

Cost. What are the costs associated with providing the intended value?

Administration, Logistics, and Communications

Person Responsible. Who is responsible for the project?

Contact Information. How should someone contact you?

Stakeholders. Who are the current stakeholders in the groups success? Is there a parent organization? Are there sponsors or investors?

More Information. Are there any documents, webpages, or repositories that provide more information about the project?

Innovator's Catechism - Ideation v1.0

Appendix J. Innovator's Catechism - Pitch

File available at <https://github.com/COGSEC/InnovatorsCatechism>

Full Title of Project

Team Name	x
[person responsible title (e.g. facilitator)]	x
Contact Information	x
Start Date	mm-dd-yyyy

Situation

Key Problems. What are the key problems the group has been formed to address?

User Segments. Who is affected by these problems?

Alternatives. What alternative solutions already exist? Why are they inadequate?

Early Adopters. Who is actively looking for a competitive edge in handling these problems, most affected by the inadequacies of the available alternatives, and flexible in adopting new solutions?

Mission

Value Proposition. Given the situation, in clear terms, with no jargon, what is your objective? What value do you aim to provide?

Potential Avenues of Approach

Approach. Given the situation and mission, what are the potential avenues of approach?

Resources. What resources are required? Which do you need? Which do you already have?

Advantage. What unique advantage is offered?

Risks. What are the risks?

Feasibility. Given the advantages offered and the risks present, what is the feasibility? Why is this project likely to succeed?

Channels. What channels will be used to introduce users to the value you intend to provide?

Milestones

Metrics. What metrics can be used to track success and measure impact?

Milestones. What are the milestones that best indicate progression toward success? When are they expected to be completed by?

Cost and Benefit

Cost. What are the costs associated with providing the intended value?

Benefits. What are the benefits of providing the intended value?

Big Picture. If successful, what else is possible?

Administration, Logistics, and Communications

Person Responsible. Who is responsible for the project?

Contact Information. How should someone contact you?

Stakeholders. Who are the current stakeholders in the groups success? Is there a parent organization? Are there sponsors or investors?

More Information. Are there any documents, webpages, or repositories that provide more information about the project?

Innovator's Catechism - Ideation v1.0