U.S. Innovation Programs Falter Because they Address the *Environment* of Innovation While China Addresses the Innovation *Directly*

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China continues to acquire a competitive advantage over the U.S. in an increasing number of areas throughout the full range of competitive environments – military, economic, political, etc. – no matter how much the U.S. increases the funding and support for innovation in these areas.

Why is that? The U.S. efforts/programs to increase the effectiveness of U.S. innovation address the *environment* in which the U.S. executes innovation and don't *directly* address the technology exploitation itself. Technology exploitation is the development, acquisition, and utilization of technology.

Presently, technology exploitation relies heavily upon serendipity. For example, it relies upon the chance meeting of two researchers at a conference where they exchange information on their respective research, which results in a cross-pollination between their research that advances their respective research or produces a totally new technology. When an organization wants to increase the probability of these chance meetings where the potential exists for the required cross-pollination to occur, they increase the funding for attendance at conferences.

Present efforts to increase the effectiveness of technology exploitation address the *psychological*, *social*, and *financial* aspects of the environment in which the technology exploitation occurs, which renders those efforts significantly less effective at increasing the effectiveness of the technology exploitation than addressing the technology exploitation directly.

Psychological – Countries/companies deploy tools and techniques to alter the environment in which individuals will be exploiting technology with the expectation that this altered environment will cause the thinking of these individuals to be more conducive for the development, acquisition, and/or utilization of technology.

Reduce fear of failure – Implement reward and funding procedures to reduce the entrepreneurs' and researchers' *fear of failure*. Set up programs at the beginning of a technology initiative such that if the initiative fails, (e.g., research did not generate the required technology), award prizes out to all participants for their effort, thereby reducing the fear of failure. The premise is that the fear of failing causes entrepreneurs and researchers to tread lightly and stay with what they consider "tried and true" when exploiting technology.

Foster creativity – Provide environments, and execute processes that may result in *fostering creativity*. Set up rooms with a variety of puzzles and toys with which to experiment (e.g., blocks, painting). Hold brainstorming sessions to get people to think "outside the box." The premise is that creativity is at the heart of technology exploitation, and it is a *magical* art that resides within an individual's mind that the environment or an activity can foster that enables the mind to "soar" with its creativity.

Fail fast – Induce researchers and those who are commercializing technology into feeling comfortable in "*failing fast*." Measure them in terms of how quickly they can get to a "go, no-go" decision and move to the next potentially viable approach for effectively exploiting the technology (e.g., bringing the research to fruition). The premise is that the faster they can move through the "failures," the quicker, and with less expenditure of funds, they will get to the "wins."

In each case, the objective is to change the mental attitude (e.g., accept failure) or abilities (e.g., increase creativity) of the individuals responsible for technology exploitation. The measure of success is how quickly an individual is ready to initiate a new program after failure or to think of a new approach to take or how wild "outside the box" that approach is.

Social – Deploy techniques in the environment to increase the productive social interactions among people exploiting technology, for example:

Shared experiences – Equip meeting rooms to foster common non-work-related activities that will reduce social barriers. Install pool tables in the rooms where military officers and researchers will meet. The premise is that a shared, casual activity will reduce the social barriers and increase the conversation between the *rigidly thinking* military officers with the "problems" and the *creatively thinking* researchers with the "solutions," resulting in a higher rate of matches between problems and solutions.

Contests – Hold open contests that pose problems or present challenges in which anyone can participate. Award prizes to the person, team, or organization who brings in a technology capability for solving the problem or overcoming the challenge. The premise is that open contests enable and foster open dialog, therefore solutions, from a larger portion of society (e.g., individuals, small start-ups).

Team building – Host events that put groups of people working on innovation into situations (often physical) in which they must think and work as a team to accomplish a task. The premise is that a team who knows how to work together will be more effective at exploiting technology.

Remove competing incentives –Determine what incentives decision makers have along the chain of technology exploitation to determine where conflicting incentives exist between steps that hinder or stall the technology exploitation process. The premise is that if all decision makers have the *same incentive* for executing their respective portions of the technology exploitation chain, more technologies will progress all the way through the chain.

In each case, the objective is to make social interactions between people exploiting technology more productive. In these cases, the measure of success of the programs is in terms like the number of follow-on meetings after the initial meetings over the pool games, the total amount of development funds awarded to the contests winners, and how many funded R&D efforts made it all the way through the technology exploitation chain resulting in equipment on the battlefield.

Financial – Increase the available funding in the environment, or take steps to increase the optimum utilization of the funds for those individuals exploiting the technology. In each case, those providing funding see the effective exploitation of funds as the foundational key to effectively exploiting the technology, for example:

Increased funding – Increase funding for technology exploitation where, in most cases, the funding increases are for R&D. The premise is that no one can know the connection between a particular action in the exploitation of technology (e.g., funding R&D for the development of a particular technology) and the resulting economic or military benefit in anything but vague terms. It is a game of percentages. In this scenario, the only way to potentially increase the economic or military benefits **from** the technology exploitation is to increase the funding **for** the

technology exploitation. A "major increase will generate a major benefit" (e.g., the CHIPS and Science Act).

Targeted R&D –Target R&D funding more effectively. Groups of diverse thought leaders convene to identify which technologies they think are the "key" to the country's economic health and/or military might. The premise is that a relatively *small*, *self-contained* set of technologies exist that the key we require to produce goods or provide services: a) in many either present or yet to emerge future industries, and/or b) that will provide a competitive advantage to a warfighter on the battlefield. And if we out-R&D the adversaries/competitors in that set of technologies (i.e., get to the R&D breakthrough finish line first), we will be guaranteed to have and maintain the required competitive advantage.

Joint funding – Propose and execute joint technology efforts among allied countries to allow for the sharing of research data and/or R&D efforts. The premise is that the more funds one applies to a technology exploitation initiative either by joining efforts or by sharing data to minimize duplicating R&D effort, the higher the odds are that the technology exploitation will come to fruition.

In each case, the objective is to utilize the funds most effectively. The initial decision is how to optimize the funds to accomplish a function (e.g., how to fund the largest number of competing R&D approaches from the available funds). And the measure of success after the fact is how effectively we optimized the funds (e.g., how many of the competing R&D approaches received funding). The reason the process appears logical and effective is that the terms of measurement are the same as those for making the initial decision (i.e., funds optimization).

Tracking – Lastly, initiate programs to improve a country's innovation by producing a "report card" that should measure the health of a country's innovation ecosystem. The executors of the program develop a list of key indicators and their related metrics that are supposed to measure the health of the various aspects of the country's innovation ecosystem (e.g., psychological, social, financial). The metrics may include items like access to capital for innovation or a well-trained 21st century workforce. The report card will assess each metric with a letter grade or a number ranking.

The objective is to provide the country's leadership with insights as to what aspects of the country's innovation ecosystem to improve. The whole “report card” approach is misdirected and will never produce the required metrics because this approach addresses the environment and not the direct exploitation of technology.

Impact of efforts – All the efforts address improving a different aspect of the environment in which technology exploitation execution occurs. We then measure the success of the efforts in terms of how much it improved that aspect of the environment. But the efforts do not directly address the sole function for exploiting technology, nor do we measure the success of the effort in terms of that sole function for exploiting technology – generating a competitive advantage. A competitive advantage is the ability to satisfy customer needs better than the competitor or adversary can satisfy customer needs.

The competitive advantage can result in acquiring customers in the marketplace, enabling a warfighter to win on the battlefield, or accomplishing an objective (e.g., eliminating hunger), but in each case, the most effective means for improving the ability to generate a competitive

advantage requires addressing the technology exploitation directly and not the environment in which technology exploitation execution occurs.

Addressing only the environment generates only minimum improvements at best (especially when the adversary/competitor is addressing the technology exploitation directly), but, in some cases, it is counter-productive (e.g., funding that significantly increases the national debt while only resulting in minor increases in the country's economic or military competitive advantage).

Address innovation directly – The laws of physics *dictate* the process of exploiting technology for a competitive advantage. The laws of physics fully dictate *how* one can develop, acquire, and utilize technology for a competitive advantage – the ability to satisfy customer needs better than the competitors can satisfy customer needs for a true competitive advantage.

The laws of physics fully dictate:

a) *Development – which* technologies, when cross-pollinated, will advance an existing technology, or produce what new technology, with what capabilities,

b) *Acquisition – which* technologies with *what* capabilities one must acquire,

c) *Utilization* – which technologies with what capabilities in what product or service

that will enable one to excel at one or more customer needs for a competitive advantage in the marketplace or on the battlefield.

The laws of physics dictate how one can exploit technology for a competitive advantage, and, in turn, dictate and enable the full *optimization* of all the other resources (e.g., funds, manpower, natural resources), which are the resources that *comprise* the environment in which one executes technology exploitation and which the present U.S. efforts/programs address via the psychological, social, and financial aspects of the environments.

China's national technology strategy outmaneuvers the U.S. in technology exploitation itself and has been successfully accomplishing this for decades. The result is that China's national technology strategy *dictates* the *effectiveness* of the Chinese and the U.S. environments for their respective exploitation of technology for a competitive advantage. This is the case for the full range of competitive environments that China's unrestrictive warfare – military, economic, social, political, etc. – addresses.

In other words, China's national technology strategy dictates how effective, or, rather, how *ineffective*, U.S. programs that address the innovation environment are in terms of increasing the effectiveness of U.S. innovation (i.e., technology exploitation).

A competitive advantage, by definition, is always *relative*. An organization's or country's capabilities are an *absolute*, but if that capability is a competitive advantage is relative. It is the relative capabilities between countries, between organizations, or between people, to satisfy one or more customer needs at a higher level than the competition is able to satisfy the customer needs. In the marketplace, the customer is the person purchasing the product that excels at satisfying his or her needs. On the battlefield, the customer is the warfighter who achieves a military victory because a new piece of weapons tech satisfied his or her needs better than the weapons tech available to adversary's warfighters satisfied their needs. The competitive advantage is concrete and measurable.

Take the following very simple, but conceptually correct, *hypothetical* example of a U.S. and a Chinese company competing in the same commercial market. The Chinese company is the dominant worldwide competitor. The U.S. company is a minor player but expects to acquire and maintain the worldwide lead by developing and introducing the next generation product into the marketplace.

The U.S. company decides to institute the "fail fast" approach to its R&D efforts for developing the new coating technology, which is pivotal for the next generation product. The company leadership institutes a formal, internal Fail Fast program (e.g., classes, training manuals) headed by a team of consultants who are the leading experts on the fail fast concept.

To maximize the benefits from their decision (e.g., increase the company stock price), the company leadership launches a PR campaign touting the fact that their aggressive Fail Fast initiative will enable the company to rapidly and efficiently move through the various approaches for the coating technology development to find the "winner" and become the highly dominant competitor worldwide.

To counter the U.S. company's Fail Fast approach, the Chinese company adds to its technology strategy and directly addresses the technology exploitation. The Chinese company determines that a small company in France is the sole producer of the test equipment required to conduct research for the development of the pivotal coating technology and purchases the company via a shell company. From its position as the new owner of the test equipment company, the Chinese company is in position to ensure that the U.S. company receives test equipment for its coating development that is both *imprecise* and *inaccurate*.

The imprecision of the test equipment's measuring ability will *increase the time* the U.S. company takes to make a "go, no go" decision on the various approaches to the research for the coating. The inaccuracy of the test equipment will cause the U.S. company to make *incorrect* "go, no go" decisions on which research approaches to continue and which to abandon. The U.S. company will pursue research approaches that will *not* result in developing a coating with the required attributes while not pursuing an approach that *would* result in a coating with the required attributes.

The imprecision of the test equipment will significantly decrease the *efficiency* of the U.S. company's technology exploitation (e.g., use of funds), and the inaccuracy of the test equipment will prevent the U.S. company's technology exploitation from *achieving* the required function – generating a competitive advantage via introducing the next generation product into the marketplace.

In addition, the acquisition of the French company puts the Chinese company in a strong position to develop and introduce the next generation product into the marketplace when it is most effective for them – the Chinese company maintains the *initiative* relative to the U.S. company and all other competitors.