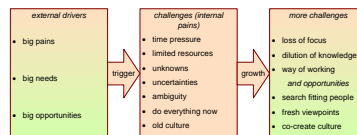


Introduction How to Engineer Systems as Start-up or in Disruptive Circumstances?

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Abstract

Start-ups and organizations responding to disruptive changes share the challenge of responding fast, often with limited suitable resources, while the environment may impose rigid ways of working. This paper explores these challenges and options to cope with them.

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1 Introduction

The common drivers for start-ups and large organizations facing disruptive events is that big pains form external drivers. When there are big pains, there are big needs; where there are big needs, there are big opportunities. Figure 1 shows the external drivers, e.g. pains, needs, and opportunities.

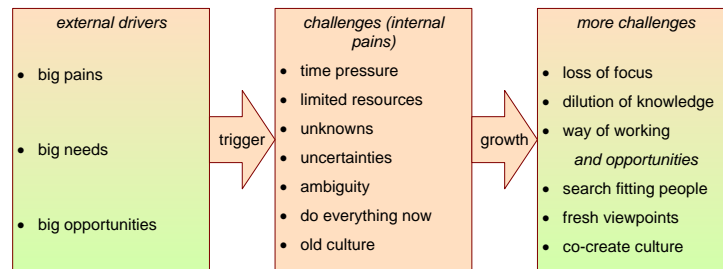


Figure 1: Disruptive Change Consequences

The drivers from the external world cause challenges for the organization(s) that must respond to the drivers. These challenges are internal pains:

Time pressure caused by the disruptive event. Note that disruptive events may have a long lead-time that become acute after decision makers ignoring it too long.

Limited resources ; in large organizations, the resources are occupied with the ongoing operational work. In start-ups, the resources aren't available yet

Unknowns caused by entering new territory, somewhere where humanity hasn't been yet

Uncertainties with the same cause as the unknowns

Ambiguity due to the pluriformity of the stakeholders, and the stakeholders themselves being in this new territory

Do everything now demands; the circumstances demand that a new capability needs to be available now with at the same time all enabling capabilities (e.g. volume production, secure and robust supply chains, training internal and external, maintenance, ...), while we also need to cope with feasibility risks.

Old culture , especially in large organizations, which may not fit the new needs.

Addressing many of the internal pains tend to require a fast growth of the organization and its ecosystem. Growth brings more challenges, however, also creates opportunities. Major challenges are:

Loss of focus on top of the problem of doing everything now for the system-of-interest, for example, recruiting resources, arranging housing and infrastructure, and adapting organization and process.

Dilution of knowledge since new resources lack the application knowledge.

Way of working that continuously needs adaptation to fit the growing organization

Opportunities are:

Search fitting people that probably will differ from the people that the organization already has.

Fresh viewpoints from new people.

Co-create culture rather than unfreeze a population that is settled.

- How to keep **focus**?
- How to cope with **chaos** and to maintain **overview**?
- How to **discover unknowns**?
- How to **reduce uncertainties** and ambiguity?
using **time** and **resources wisely**
- How to **lead others** in the organization?
- How to **engage external stakeholders**?
- How to **orchestrate** the **ecosystem**?

Figure 2: Questions that the problems, challenges, and opportunities raise

The problems, challenges, and opportunities raise questions that Figure 2 shows.

2 Examples of Disruptive Events

Figure 3 shows several examples of disruptive events in a few domains: defense (neglect and dependence), health care (infarct) and the climate and environment (emergency). There are many more, e.g. housing, food, and democracy, to name a few more.

In defense geopolitical changes, e.g. Russia's aggression, USA withdrawal, and China's overwhelming development change the geopolitical landscape much.

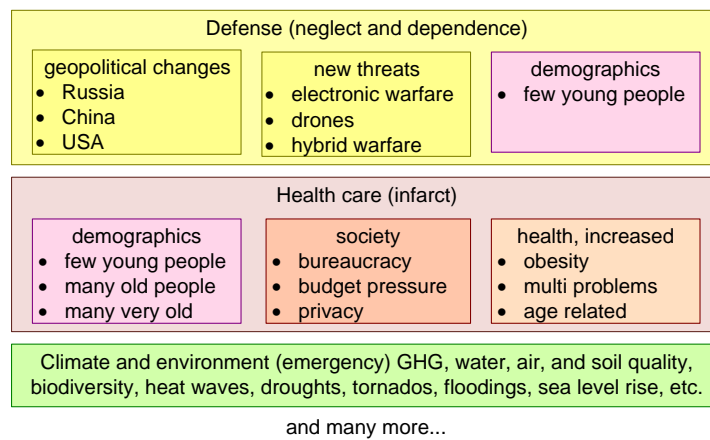


Figure 3: Examples of disruptive events

Technical developments in materials, sensors, effectors, computing power, data processing and analysis (wrongly named AI), control, and communication enable remotely controlled operation of drones in air, under water, above water, and on land. These systems come with new capabilities and weaknesses, where electronic warfare palys dominantly, influencing communication, and positoning. The defense organization needs to revise most of iots doctrines, and consequently, needs to retrain and reorganize itself completely. Meanwhile, most countries have much less young people available that will staff the defense organization.

In Healthcare, demograohics plays a dominating role too. The population will have much less young people, while there are many old and very old people. At the same time, the population is less healthy with many more obese people. The older people tend to have multiple health problems, complicatin the care. They also suffer from age-related health issues, e.g, cardio-vascular, cancer, and dementia. Society amd thegovernemnt have increased the bureaucracy in an attempt to control cost and quality (and to cover asses, when there are problems). Most western countries spend a major part of their GDP on hekath care. Increasing privacy regulations and expectations complicate the care further.

Climate and environment can fill a series of books, I will nto elaborate them here.

3 Light-Weight Architecting

Figure 4 shows my assertion that li8ght-weight architecting is an answer to the first set of questions to keep focus, maintain overview, discover unknwons, and to reduce uncertainties and ambiguity. Light-weight architecting requires time-

- How to keep **focus**?
 - How to cope with **chaos** and to maintain **overview**?
 - How to **discover unknowns**?
 - How to **reduce uncertainties** and ambiguity?
- **Time-box** and **iterate** relentlessly
 - over a **wide variety** of **viewpoints**
 - while **zooming-in** and **zooming-out**
 - and **capturing insights simple** and **pragmatic**

Figure 4: First Answer: Use Light-Weight Architecting

boxing and iterating relentlessly over a wide variety of viewpoints, while zooming-in and zooming-out and capturing insights simple and pragmatic.

- How to **lead others** in the organization?
 - How to **engage external stakeholders**?
 - How to **orchestrate** the **ecosystem**?
- Using **leadership** skills bridging **ratio** and **feelings**
 - to **manage self** (which requires knowing yourself well)
 - and to **connect to others** emotionally as well as rationally
 - such that interaction happens in **learning mode**

Figure 5: Answer Part 2: Use Light-Weight Archiecting

Figure 5 shows leadership as the answers to the remaining questions. Using leadership skills bridging ratio and feelings to manage self (which requires knowing yourself well) and to connect to others emotionally as well as rationally such that interaction happens in learning mode

References

- [1] Gerrit Muller. The system architecture homepage. <http://www.gaudisite.nl/index.html>, 1999.

History

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- added TESDCIquestions
- changed status to draft
- added Section Light-weight architecting

Version: 0.1, date: May 31, 2026 changed by: Gerrit Muller

- updated TESDCIproblem
- changed status to preliminary draft
- defined TESDCIproblem as logo
- added TESDCI disruptiveEvents

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- Created, no changelog yet