FACULTY OF SCIENCE

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<tr><td colspan="2">ACADEMY OF COMPUTER SCIENCE AND SOFTWARE ENGINEERING
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DATE: 2021/11/02   **SESSION:** 8:30 – 23:59

ASSESSOR(S)   Prof JJ Langerman

INTERNAL MODERATOR

EXTERNAL MODERATOR   Prof. AN Wausi
                                                         University of Nairobi, Kenya

DURATION: Day   **MARKS:**   100

THIS PAPER CONSISTS OF 10 PAGES INCLUDING THE COVER PAGE

INSTRUCTIONS:

- This is an open book assessment.
- Read the questions carefully and answer only what is asked.
- Number your answers clearly.
- Only typed assignments will be accepted.
- Structure your answers by using appropriate headings and sub-headings.
- The general University of Johannesburg policies, procedures and rules pertaining to written assessments apply to this assessment.

Question

An investor approached you to start a business that will utilise the technologies and thinking of the 4th Industrial Revolution. She forwarded you the attached article she read in The Economist (African countries must get smarter with their agriculture, *The Economist*, March 26[th,] 2020)

Based on this she wants you to put a proposal together for a company that could address these problems. The proposal should consist of the following:

1) A high-level overview of the solution you propose utilising as much technologies of the 4th Industrial Revolution as possible. Also develop a North Star statement for the company. [5]
2) A strategy built specifically tailored to start-ups and platforms. [20]
3) A business model canvas outlining the business proposition. [10]
4) A discussion on how you would protect the platform strategy from failure. [12]
5) Discuss how you will achieve organisational agility across the organisation from the C-Suite to the delivery teams. [23]
6) Outline the specific engineering practises to enable this vision. [10]
7) Give advice on how to implement a culture change strategy. [20]

Notes:

No references or generic discussions are necessary. Marks will be awarded for how the idea will be applied. For example, don't write: "A modern development language will be used together with Cloud technology". Rather say: "We will be hosting out analytics engine on AWS Cloud and the base language will be Python". Don't say "Work will be done by cross-functional teams." Rather stay: "Work will happen in cross-functional teams consisting of designers, engineers that acts as coders and testers together with a scrum master."

A guideline on the proposal should be 10 pages with a font size on 12pt and 1 ½ line spacing. Work on 10 marks a page.

African countries must get smarter with their agriculture
The Economist
Staff Writer
March 26th, 2020

On the hills of central Kenya, almost lime-green with the shimmer of tea bushes in the sunlight, farmers know all about climate change. "The rainy season is not predictable," says one. "When it is supposed to rain it doesn't, then it all comes at once." Climate change is an issue that will affect everyone on the planet. For Africans its consequences will be particularly bitter: whereas other regions were able to grow rich by burning coal and oil, Africa will pay much of the human price without having enjoyed the benefits. "Africa only represents 2% of global greenhouse-gas emissions but it is the continent that is expected to suffer the most from climate impacts," says Mafalda Duarte, who runs the $8bn Climate Investment Funds, established by the World Bank.

Although there are huge uncertainties as to the precise impacts of climate change, with large error bars around temperature forecasts, enough is known to say that global warming represents one of the main threats to Africa's prosperity. Parts of the continent are already warming much more quickly than the average: temperatures in southern Africa have increased by about twice the global rate over the past 50 years. Even if the world were to cut emissions enough to keep global warming below 1.5°C, heatwaves would intensify in Africa and diseases such as malaria would spread to areas that are not currently affected. Farming would also be hit hard. About 40% of the land now used to grow maize would no longer be suitable for it. Overall, it is estimated that maize yields would fall by 18-22%.

Africa is particularly vulnerable, in part because it is already struggling to feed itself and it will have to vastly increase yields and productivity if it is to put food on the plates of a fast-growing population, even without climate change. The un's Food and Agriculture Organisation reckons that by 2050 global food production would have to rise by about 70% over its level of 2009 to meet demand from a population that is growing in numbers and appetite. Much of this new demand will be in Africa. Yet the continent already imports about $50bn-worth of food a year and that figure is expected to more than double over the next five years. Self-sufficiency is not Africa's goal, but the fact that it spends more money importing food than it does buying capital goods suggests it has room for improvement.

Finding out why is not hard. Most farms are tiny, tilled by hand and reliant on rain. More than half of Africa's people make their living from farming. Although its total harvest has climbed over the past few decades, this is mainly because there are more people farming more land. But in many places there is no spare land to farm. Plots in Rwanda are so small (less than two acres) that you could fit 250 of them onto the average American farm. And although output per worker has improved by little more than half over the past 30 years in Africa, that is still far behind the 2.5 times improvement in Asia. Yields of maize, a staple, are generally less than two tonnes per hectare, a fifth the level in America.

The low productivity of African farmers is reflected both in national economic statistics—despite absorbing so much labour farming generates just 15% of gdp—as well as in their poverty, which is generally concentrated in rural areas. "They can't even feed their families," says Jennifer Blanke, a vice-president of the African Development Bank in charge of agriculture. "[Farm] productivity hasn't improved in many parts of Africa for 100 years."

One reason is that in the first few decades of independence many African governments neglected farming as they focused on industrialising their economies. Others damaged it by pushing down the prices that state monopolies paid for their crops in order to subsidise workers in cities with cheap food. Ghana taxed cocoa exports so heavily that production collapsed by half between the 1960s and 1980s, despite a jump in the price of cocoa. Yet over the past two decades or so governments and donors have begun to look afresh at farming as a way of providing jobs for the 13m young people entering the workforce each year. Much of the focus has been on getting smallholder farmers to use fertiliser and, more important, better seeds. The results can be impressive. Improved varieties of sorghum, for instance, can produce a crop that is 40% larger than the usual variety. Infrastructure is important. A World Bank irrigation project in Ethiopia helped farmers increase their potato harvest from about 8 tonnes per hectare to 35 tonnes.
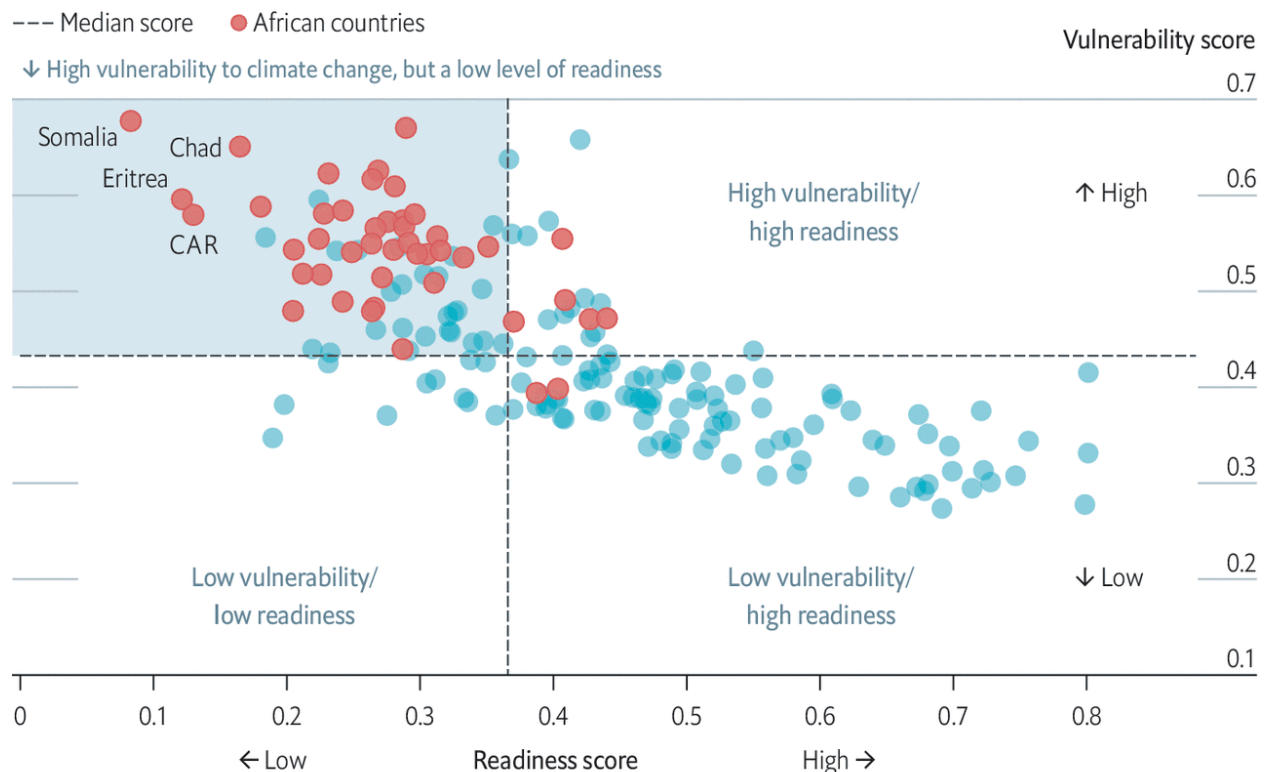
Better techniques help, too. Smallholder coffee farmers in Kenya are able to increase their incomes by 40% by following a few simple guidelines on caring for their bushes, such as trimming all but three of their stems. Many of their neighbours do not follow the advice, because it seems counter-intuitive. More stems ought to lead to more coffee beans, they say. Yet after seeing those following the advice get bigger harvests for a season or two, many others start doing the same.

One way of spreading knowledge is to link farms to big buyers of their harvests. When Diageo, a British drinks giant, built a brewery in Kisumu in western Kenya, it wanted to use local crops to make a beer cheap enough to compete with illicit home-brew. It organised farmers into groups, improved supply chains for them to get seeds and fertiliser and then agreed to buy their grain. It now provides a market to about 17,000 farmers. Across the region it has doubled its use of local raw material to about 80% over five years, says John O'Keeffe, who runs its Africa business.

Other industries are also benefiting from technology and capital. Jane Toko, a mother of eight, earned a living for most of her adult life catching fish in Lake Victoria, the world's third-largest lake. "Long ago the number of fish was high," she says. "Now they are few." Dotted along the shore are hundreds of small hamlets, whose residents have fished the lake for generations. This rich source of protein helped the population in the area expand from about 10m in 1960 to more than 40m now, contributing to overfishing. Global warming is also having an impact by reducing the amount of oxygen dissolved in parts of the lake, cutting by 40% the habitat available for fish. Data are sparse but some surveys suggest that the total amount of perch in the lake fell by almost half between 1999 and 2011. Locals say the catch of tilapia, a native freshwater fish that is particularly delicious grilled, has fallen 80%. "There are so many people fishing on the lake, but what comes out is small," grumbles Maurice Muma, a fish trader.

Danger zone

Climate vulnerability and adaptation readiness index*, by country, 2017

--- Median score   ● African countries

Vulnerability score

↓ High vulnerability to climate change, but a low level of readiness

Somalia ●
Chad ●
Eritrea
CAR

High vulnerability/
high readiness

↑ High

0.7

0.6

0.5

0.4

0.3

0.2

0.1

Low vulnerability/
low readiness

Low vulnerability/
high readiness

↓ Low

0   0.1   0.2   0.3   0.4   0.5   0.6   0.7   0.8

← Low   Readiness score   High →

Source: The Notre Dame-Global Adaptation
Index (ND-GAIN) Country Index

*74 variables to form 45 core indicators to measure
vulnerability and readiness of 192 UN countries

The Economist

The shrinking fishery has contributed not just to poverty, but also a higher rate of hiv infections by giving fishermen the bargaining power to demand that female traders have sex with them in order to buy their fish. Yet a few kilometres away is part of the solution to the declining catch. Victory Farms, which was founded by two Americans in 2015, has become sub-Saharan Africa's fastest-growing fish farm. Ponds hold a teeming mass of pregnant fish. Two employees, waist deep in water, sort them and squeeze out the eggs which are hatched in bubbling indoor tanks. Out on the lake floating cages house thousands of growing tilapia. The farm is on track to produce about 10,000 tonnes of fish this year, which is enough to feed about 1m people at Africa's current rate of fish consumption. The firm hopes to expand to about 60,000 tonnes over the next six years, a figure that would equal more than half of the wild catch in the Kenyan side of the lake. Others are following the example. A recent study by two Kenyan academics found about 4,000 cages in Kenyan waters.

An even more important change is the move from traditional farming to building businesses that can profitably bring technology and investment to smallholder farmers. Taita Ngetich, a young Kenyan, was studying engineering when he wanted to earn a little money on the side. He scraped together 20,000 Kenyan shillings (about $200) to plant tomatoes. Everything went wrong. The crop was attacked by pests. "Then there was a massive flood that swallowed all our capital," he says. Mr Ngetich persevered by looking into buying a greenhouse to protect his plants from bugs and rain. The cheapest ones cost more than $2,500 each. So he designed his own for half the price. Soon neighbouring farmers started

placing orders. His firm, Illuminum Greenhouses, has sold more than 1,400 greenhouses that provide livelihoods to about 6,000 people. The business does not stop there. He also supplies fertiliser, high-quality seedlings and smart sensors that increase yields.

Illuminum's success shows how technology can help even small farms be more productive. Because such a large share of Africa's population earns a living from agriculture, even small improvements in productivity can lift the incomes of millions of people. But over the longer run smallholder farming can go only so far, especially in the face of climate change and population pressure.

"If we really want to lift people out of poverty we have to finance projects that will get them an income of at least $100 a month so that they can pay for health care and education," says Mr Ngetich. "Projects that give them an extra $2 a month from growing beans or maize aren't going to get them there." Getting those big jumps will need better jobs in factories and cities.

Question 1

We are looking to see if the student has addressed the issues raised in the case study, applied 4IR and if in general the idea makes sense.
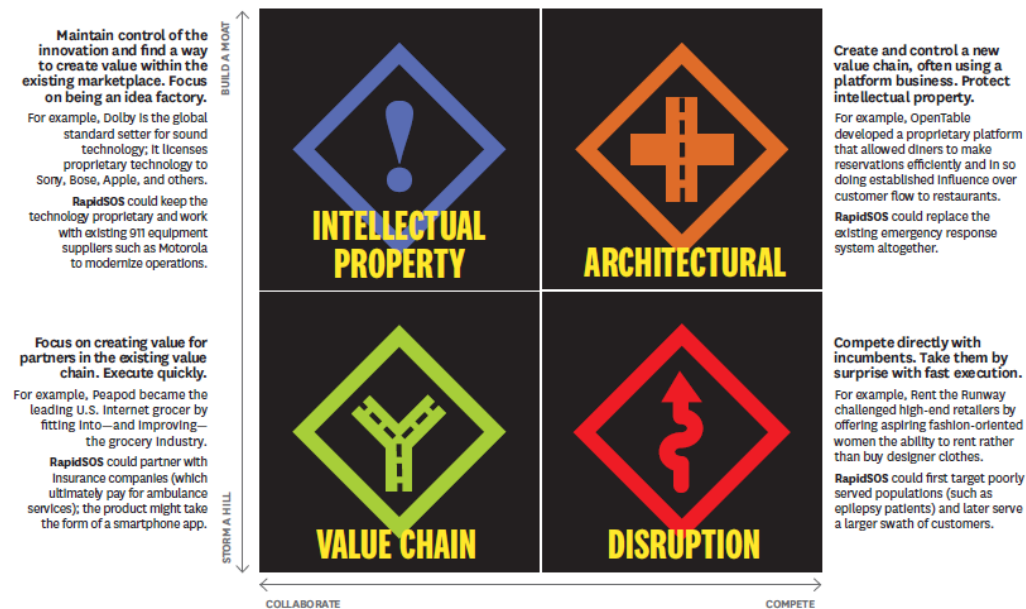
- 5 marks based on quality.

Question 2

For this we would like to see how the student applied the tools listed below.

- 3 marks for discussion on platform (what is is etc)
- 5 marks for strategy compass and one selected
- 12 marks for practical discussion on decisions.

THE ENTREPRENEURIAL STRATEGY COMPASS

Strategic opportunities for new ventures can be categorized along two dimensions: attitude toward incumbents (collaborate or compete?) and attitude toward the innovation (build a moat or storm a hill?). This produces four distinct strategies that will guide a venture's decisions regarding customers, technologies, identity, and competitive space. The emergency-services provider RapidSOS used the compass to explore its strategic options.

Maintain control of the innovation and find a way to create value within the existing marketplace. Focus on being an idea factory.

For example, Dolby is the global standard setter for sound technology; it licenses proprietary technology to Sony, Bose, Apple, and others.

RapidSOS could keep the technology proprietary and work with existing 911 equipment suppliers such as Motorola to modernize operations.

INTELLECTUAL PROPERTY

Create and control a new value chain, often using a platform business. Protect intellectual property.

For example, OpenTable developed a proprietary platform that allowed diners to make reservations efficiently and in so doing established influence over customer flow to restaurants.

RapidSOS could replace the existing emergency response system altogether.

ARCHITECTURAL

Focus on creating value for partners in the existing value chain. Execute quickly.

For example, Peapod became the leading U.S. internet grocer by fitting into—and improving—the grocery industry.

RapidSOS could partner with insurance companies (which ultimately pay for ambulance services); the product might take the form of a smartphone app.

VALUE CHAIN

Compete directly with incumbents. Take them by surprise with fast execution.

For example, Rent the Runway challenged high-end retailers by offering aspiring fashion-oriented women the ability to rent rather than buy designer clothes.

RapidSOS could first target poorly served populations (such as epilepsy patients) and later serve a larger swath of customers.

DISRUPTION

BUILD A MOAT / STORM A HILL

COLLABORATE — COMPETE

THE FOUR DECISIONS

At least four domains of decision making are crucial for every venture. Although any company will face additional choices that are particular to its context, a start-up that has not wrestled with at least these four decisions is unlikely to create and capture value on a sustainable basis. Amazon's story is illustrative.

CUSTOMERS

Identifying customers and understanding their needs is usually the first step in any go-to-market strategy. But the target customer is not necessarily the first customer—and it is important that you understand the relationship between the two. You validate your product by getting the right early adopters. Amazon's decision to initially target book readers was a strategic choice. Its leadership recognized that books were a beachhead from which the company could expand into other retail categories.

TECHNOLOGY

Technology and customer choices are interrelated. Amazon could have built a simple online ordering system to service existing stores. Instead its goal was to let consumers buy the long tail of books that could not be stocked physically at the local mall. Thus the company had to invest beyond transaction services to build a database and a search engine capable of guiding readers through millions rather than thousands of books.

IDENTITY, CULTURE, AND CAPABILITIES

Choices in this category should both create a narrative about what the company will stand for and communicate to all stakeholders what behavior to expect and what capabilities it will develop. Readers loved Amazon's offer, and Wall Street quickly saw how much money the company could make. But Amazon's founder, Jeff Bezos, wasn't building a bookstore. He wanted to create the "everything store." That would require that ordinary consumers trust they were getting a good deal, which meant that Amazon would focus relentlessly on lowering prices, despite pressure from investors for early returns.

COMPETITORS

Amazon defined its competition as other retailers and chose to compete aggressively by offering consumers more choice, greater reliability, and lower prices. In its early days it could easily have chosen to work with existing retailers—perhaps even defining them as customers. Competitors would have been other search and logistics service providers, and the company could have established itself as a premium service provider by adding more value for booksellers.

Question 3

For this question we are looking for any implementation of a business model canvas.

- 1 mark per block if the answer makes sense.

Question4

A discussion around:

1. Failure to optimise openness
2. Failure to engage developers
3. Failure to share the surplus
4. Failure to launch the right side
5. Failure to put critical mass ahead of money
6. Failure of imagination

- 2 marks per failure.

Question 5

For this question we are looking for the overall structure of Agility.
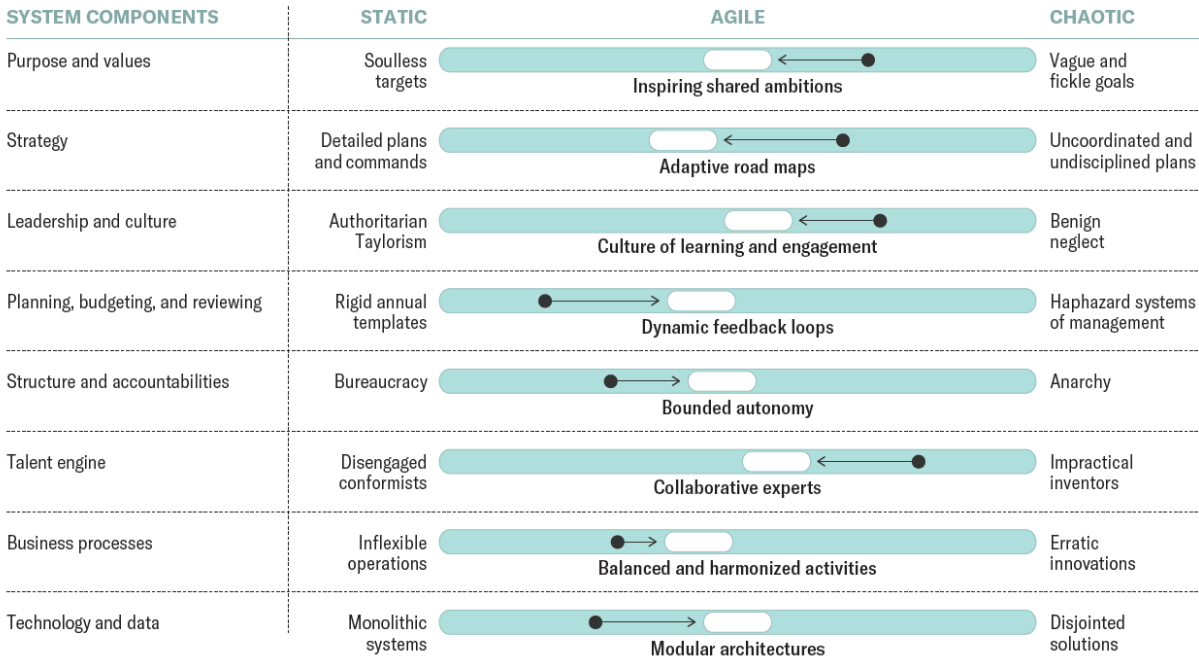
- 23 marks across the all the following.

Balancing the Agile Enterprise

A business operating system comprises many components, each of which can get out of balance. To create an agile enterprise, the agile leadership team identifies the optimal balance point for each component—this may not fall in the center, depending on the firm's context and circumstances—and then assesses where rebalancing is needed.

SAMPLE COMPANY

- Ideal agile balance point
- Where the company actually is
- Rebalancing needed

| SYSTEM COMPONENTS	STATIC	AGILE	CHAOTIC
Purpose and values	Soulless targets	Inspiring shared ambitions	Vague and fickle goals
Strategy	Detailed plans and commands	Adaptive road maps	Uncoordinated and undisciplined plans
Leadership and culture	Authoritarian Taylorism	Culture of learning and engagement	Benign neglect
Planning, budgeting, and reviewing	Rigid annual templates	Dynamic feedback loops	Haphazard systems of management
Structure and accountabilities	Bureaucracy	Bounded autonomy	Anarchy
Talent engine	Disengaged conformists	Collaborative experts	Impractical inventors
Business processes	Inflexible operations	Balanced and harmonized activities	Erratic innovations
Technology and data	Monolithic systems	Modular architectures	Disjointed solutions

Source: Bain & Co.

Trademark		Organizational agility practices[1]
STRATEGY	North Star embodied across the organization	■ Shared purpose and vision ■ Sensing and seizing opportunities ■ Flexible resource allocation ■ Actionable strategic guidance
STRUCTURE	Network of empowered teams	■ Clear, flat structure ■ Clear accountable roles ■ Hands-on governance ■ Robust communities of practice ■ Active partnerships and eco-system ■ Open physical and virtual environment ■ Fit-for-purpose accountable cells
PROCESS	Rapid decision and learning cycles	■ Rapid iteration and experimentation ■ Standardized ways of working ■ Performance orientation ■ Information transparency ■ Continuous learning ■ Action-oriented decision making
PEOPLE	Dynamic people model that ignites passion	■ Cohesive community ■ Shared and servant leadership ■ Entrepreneurial drive ■ Role mobility
TECHNOLOGY	Next generation enabling technology	■ Evolving technology architecture, systems, and tools ■ Next-generation technology development and delivery practices

Question 6

This is wide ranging – any engineering practices are acceptable. We haven't discussed this in class *per se* but I expect that a student at this level would know some of this or any other topics from general software engineering.
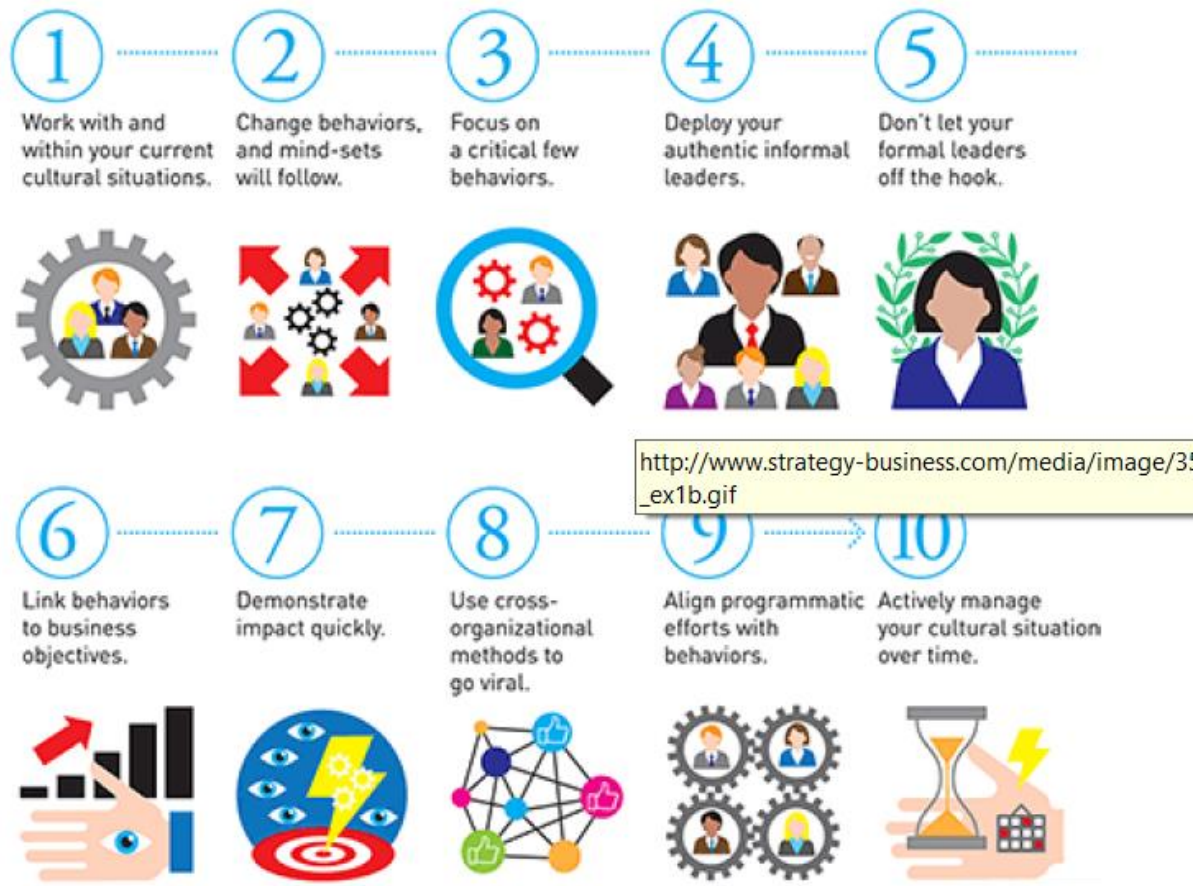
- 10 marks for 10 engineering practises.
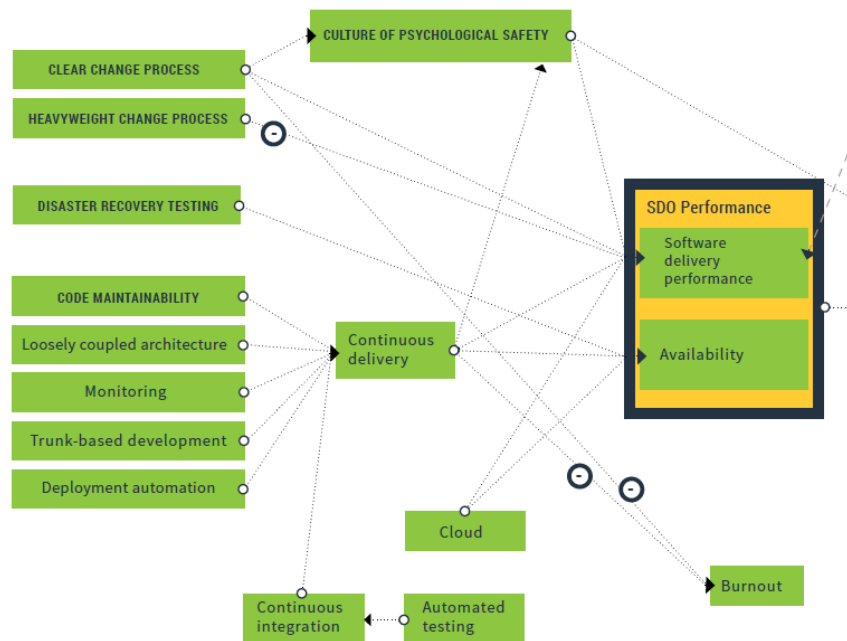
Question 7

This is a wide-ranging question. We discussed many articles in class so wont list them here. What we are looking for is that the student has applied their mind to a change strategy.

- 20 marks based on diagram.

1 Work with and within your current cultural situations.

2 Change behaviors, and mind-sets will follow.

3 Focus on a critical few behaviors.

4 Deploy your authentic informal leaders.

5 Don't let your formal leaders off the hook.

http://www.strategy-business.com/media/image/3_ex1b.gif

6 Link behaviors to business objectives.

7 Demonstrate impact quickly.

8 Use cross-organizational methods to go viral.

9 Align programmatic efforts with behaviors.

10 Actively manage your cultural situation over time.

TOTAL: [100]