

Software Factories Exam Memorandum

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*, 26 March 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 on eco-system and platform thinking [20]
- 3) A balanced scorecard that outlines how the organisation will be measured. [10]
- 4) A conceptual architecture view outlining the operating model considerations as well as the planner view of the Zachman framework [20]
- 5) Discuss how you will achieve organisational agility across the organisation from the C-Suite to the delivery teams. [20]
- 6) Outline the specific engineering practises to enable this vision [10]
- 7) A service management model for the organisation [10]
- 8) Outline the specific culture you want to foster in the organisation [5]

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 our analytics engine on AWS Cloud and the base language will be Python". Don't say "Work will be done by cross-functional teams." Rather say: "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.

How Digital Technology Is Changing Farming in Africa

by Ndubuisi Ekekwe

MAY 18, 2017

Harvard Business Review

According to the Food and Agriculture Organization of the United Nations, the world population will reach 9.1 billion by 2050, and to feed that number of people, global food production will need to grow by 70%. For Africa, which is projected to be home to about 2 billion people by then, farm productivity must accelerate at a faster rate than the global average to avoid continued mass hunger.

The food challenges in Africa are multipronged: The population is growing, but it is threatened by low farm productivity exacerbated by weather changes, shorter fallow periods, and rural-urban migration that deprives farming communities of young people. In Northern Nigeria, herdsman are moving south looking for pasture as their ancestral lands face severe deforestation. In Somalia, the Shabelle River, which supports many farmers, is drying up, causing additional pains in the war-torn country. The combination of higher food demand, stunted yield potential, and increasingly worse farmland must stimulate a redesigned agro-sector for assured food security. Agriculture accounts for more than 30% of the continent's GDP and employs more than 60% of its working population.

For decades, African governments have used many policy instruments to improve farm productivity. But most farmers are still only marginally improving yields. Some continue to use traditional processes that depend heavily on historical norms, or use tools like hoes and cutlasses that have not evolved for centuries. In some Igbo communities in Nigeria, where I live, it's common for farmers to plant according to the phases of the moon and attribute variability in their harvests to gods rather than to their own methods.

Those that do look to leverage new technologies run into financial issues. Foreign-made farm technologies remain unappealing to farmers in Africa because they are cumbersome for those who control, on average, 1.6 hectares of farmland. What's more, less than 1% of commercial lending goes into agriculture (usually to the few large-scale farmers), so smaller farms cannot acquire such expensive tools.

But this is about to change. African entrepreneurs are now interested in how farmers work and how they can help improve yields. The barrier of entry into farming technology has dropped, as cloud computing, computing systems, connectivity, open-source software, and other digital tools have become increasingly affordable and accessible. Entrepreneurs can now deliver solutions to small-size African farms at cost models that farmers can afford.

For example, aerial images from satellites or drones, weather forecasts, and soil sensors are making it possible to manage crop growth in real time. Automated systems provide early warnings if there are deviations from normal growth or other factors. Zenvus, a Nigerian precision farming startup (which I own), measures and analyzes soil data like temperature, nutrients, and vegetative health to help farmers apply the right fertilizer and optimally irrigate their farms. The process improves farm productivity and reduces input waste by using analytics to facilitate data-driven farming practices for

small-scale farmers. UjuziKilimo, a Kenyan startup, uses big data and analytic capabilities to transform farmers into a knowledge-based community, with the goal of improving productivity through precision insights. This helps to adjust irrigation and determine the needs of individual plants. And SunCulture, which sells drip irrigation kits that use solar energy to pump water from any source, has made irrigation affordable.

Beyond precision farming, financial solutions designed for farmers are blossoming. FarmDrive, a Kenyan enterprise, connects unbanked and underserved smallholder farmers to credit, while helping financial institutions cost-effectively increase their agricultural loan portfolios. Kenyan startup MFarm and Cameroon's AgroSpaces provide pricing data to remove price asymmetry between farmers and buyers, making it possible for farmers to earn more.

Ghana-based Farmerline and AgroCenta deploy mobile and web technologies that bring farming advice, weather forecasts, market information, and financial tips to farmers, who are traditionally out of reach, due to barriers in connectivity, literacy, or language. Sokopepe uses SMS and web tools to offer market information and farm record management services to farmers.

Major global corporations have tried to advance digitalization of African agriculture by launching payment systems, credit platforms, and digital insurance. But to serve largely subsistence farmers, they have to compete against the local startups — particularly on cost of service in a highly fragmented business, with no easy path to scale, owing to illiteracy, language, border constraints, and native dogmas. The microentrepreneurs with a specific focus on their domains have inherent advantages.

While it is still early to evaluate the impacts of this digitalization of farming systems in Africa, in terms of productivity and improvement of human welfare, there is already a promising trend: Technology is making farming exciting for young people. As they see that developing mobile apps alone cannot feed Africa, many will turn to farming as a business.

But they must be ready to confront institutional challenges in the industry. Critical infrastructure is still required to truly digitally transform agriculture in Africa. The continent does not have a comprehensive soil map similar to the U.S. Web Soil Survey to provide soil data and information. The implication is that the smart farming startups must build such a map as they introduce their technologies across the continent. Alternatively, governments or the African Union could fund largescale soil map to accelerate precision farming.

Most of the farms are in areas with limited connectivity, making full technology integration in real time challenging. As countries such as Ethiopia launch satellites, considering how farmers can benefit from such initiatives will be critical. Improved farm connectivity will usher in a new dawn in agriculture technology in the continent.

But entrepreneurs will need to work with the people themselves. Norms and traditions are prevalent in African agriculture, and just as many farmers initially rejected inorganic fertilizers, fearing that they would irreversibly poison the land, individuals may be resistant to changing their farming methods. Agro-tech pioneers must turn farmers into believers by using field demonstrations to show that new technologies can deliver better results.

Finally, Africa needs to cut its food waste in regions where electricity is unreliable or unavailable. The biggest impact will come when the little that is produced can be effectively utilized through appropriate

preservation and storage techniques. Pioneering affordable solutions on food safety and tracking food supply chains will boost the overall value of the sector. Digital technology opens vast untapped potential for farmers, investors, and entrepreneurs to improve efficiency of food production and consumption in Africa. From precision farming to an efficient food supply chain, technology could bring major economic, social, and environmental benefits. Indeed, the sheer optimism across the startup ecosystem is that extreme hunger can be cured in Africa, in this generation, by significantly transforming the industry that employs most of its citizens.

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.

Question 2

For this we would like to see how the student applied the 4C model and the other tools listed below.

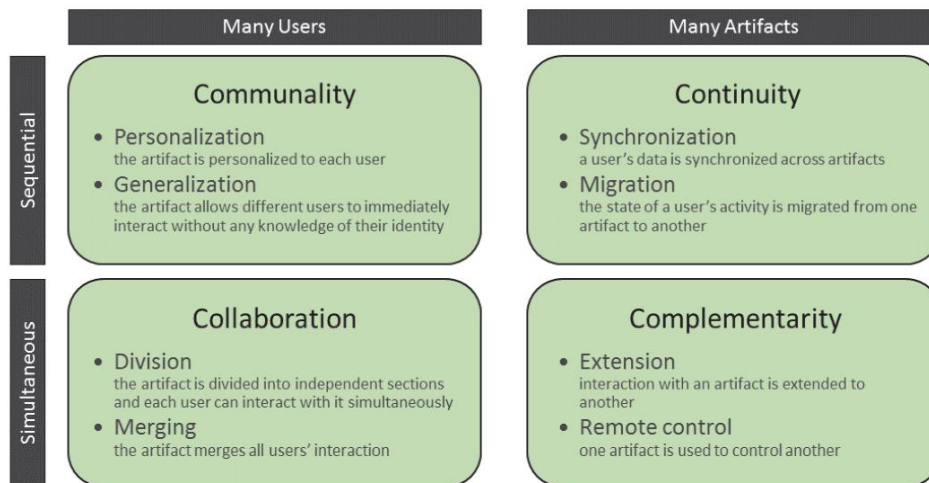
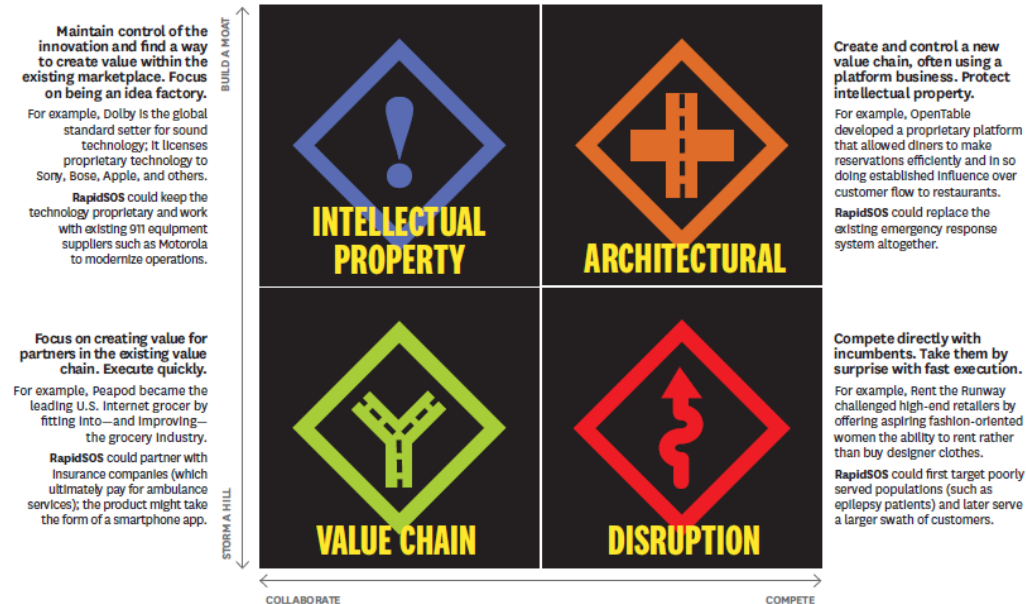


Figure 3. The 4C framework of principles for interaction design in digital ecosystems

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.



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 the idea to a balanced score card. As this is such an overused concept any modern implementation will gain extra marks.

Mission: Provide responsive, professional finance and accounting services for the people who defend America

Vision:

Best Value to our customers

- World-class provider of finance and accounting services
- Trusted, innovative financial partner
- One Organization, One Identity
- Employer of choice, providing a progressive and professional work environment

Goals

- Fully satisfy customer requirements and aggressively resolve problems to deliver best value services
- Use performance metrics to drive best business practices and achieve high quality results
- Optimize the mix of our military, civilian, and contractor workforce
- Establish consultative relationships with leaders
- Deliver business intelligence to enable better decisions
- Ensure everyone is working towards the same vision and can connect what they're doing to make that vision a reality
- Embrace continuous learning for our workforce to ensure critical, high quality skill sets
- Develop the next generation of DFAS leadership

CUSTOMER PERSPECTIVE

- Improve client/customer satisfaction

FINANCIAL PERSPECTIVE

- Reduce cost to the client/customer
- Expand the use of competitive sourcing

INTERNAL PERSPECTIVE

- Improve and leverage quality
- Encourage innovation
- Deliver system solutions

GROWTH & LEARNING PERSPECTIVE

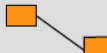
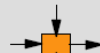
- Enhance employee competence
- Increase employee satisfaction
- Enhance ability to recruit and retain DFAS talent
- Develop climate for action

Question4

For this question we are looking at the application of Ross and Zachman.

Business Process Integration

Business Process Integration	High	Coordination - Shared customers, products or suppliers - Impact on other business unit transactions - Operationally unique business units or functions - Autonomous business management - Business unit control over business process design - Shared customer/supplier/product data - Consensus processes for designing IT infrastructure services; IT application decisions are made in business units	Unification - Customers and suppliers may be local or global - Globally integrated business processes often with support of enterprise systems - Business units with similar or overlapping operations - Centralized management often applying functional/process/business unit matrices - High-level process owners design standardized process - Centrally mandated databases - IT decisions made centrally
	Low	Diversification - Few, if any, shared customers or suppliers - Independent transactions - Operationally unique business units - Autonomous business management - Business unit control over business process design - Few data standards across business units - Most IT decisions made within business units.	Replication - Few, if any, shared customers - Independent transactions aggregated at a high level - Operationally similar business units - Autonomous business unit leaders with limited discretion over processes - Centralized (or federal) control over business process design - Standardized data definitions but data locally owned with some aggregation at corporate - Centrally mandated IT services
		Low	High
Business Process Standardization			

ENTERPRISE ARCHITECTURE - A FRAMEWORK TM							
	DATA <i>What</i>	FUNCTION <i>How</i>	NETWORK <i>Where</i>	PEOPLE <i>Who</i>	TIME <i>When</i>	MOTIVATION <i>Why</i>	
SCOPE (CONTEXTUAL)	List of Things Important to the Business 	List of Processes the Business Performs 	List of Locations in which the Business Operates 	List of Organizations Important to the Business 	List of Events/Cycles Significant to the Business 	List of Business Goals/Strategies 	SCOPE (CONTEXTUAL)
Planner	ENTITY = Class of Business Thing	Process = Class of Business Process	Node = Major Business Location	People = Major Organization Unit	Time = Major Business Event/Cycle	Ends/Means = Major Business Goal/Strategy	Planner
BUSINESS MODEL (CONCEPTUAL)	e.g. Semantic Model 	e.g. Business Process Model 	e.g. Business Logistics System 	e.g. Work Flow Model 	e.g. Master Schedule 	e.g. Business Plan 	BUSINESS MODEL (CONCEPTUAL)
Owner	Ent = Business Entity Reln = Business Relationship	Proc = Business Process I/O = Business Resources	Node = Business Location Link = Business Linkage	People = Organization Unit Work = Work Product	Time = Business Event Cycle = Business Cycle	End = Business Objective Means = Business Strategy	Owner

Question 5

For this question we are looking for the overall structure of Agility and a discussion on SCRUM.

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

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



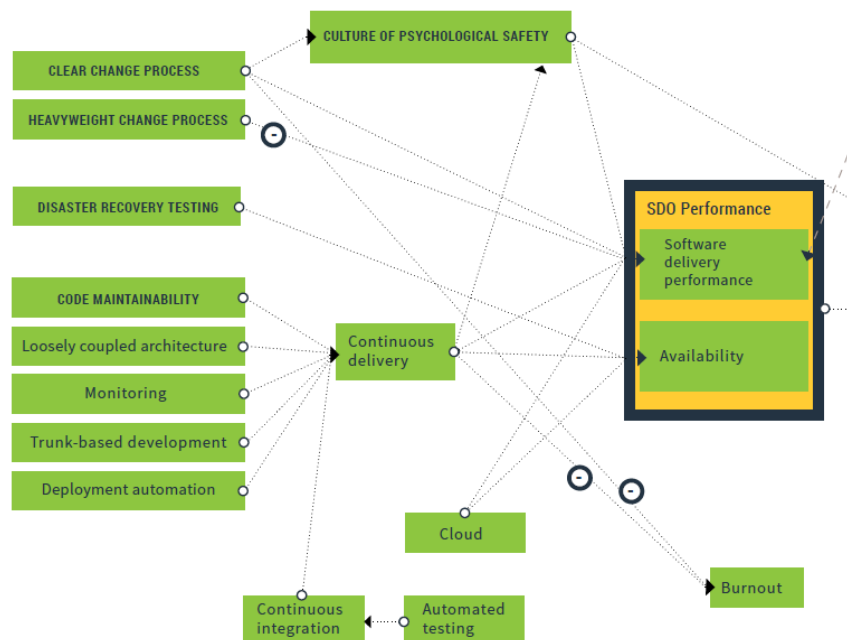
- Evolving technology architecture, systems, and tools
- Next-generation technology development and delivery practices



The Scrum Team.....	6
The Product Owner	6
The Development Team.....	7
The Scrum Master	7
Scrum Events	9
The Sprint	9
Sprint Planning	10
Daily Scrum.....	12
Sprint Review	13
Sprint Retrospective.....	14
Scrum Artifacts	14
Product Backlog.....	15
Sprint Backlog.....	16
Increment	17
Artifact Transparency.....	17
Definition of “Done”	18

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.



Question 7

This is a wide-ranging question. We discussed many articles in class so won't list them here. What we are looking for is that the student has applied their mind to what a modern progressive culture could look like.

Question 8

For this question we want to see the student apply ITIL as a service management framework to the problem.

- Service Strategy
- Service Design
- Service Transition
- Service Operation
- Continual Service Improvement.