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### **Context**

* Generative AI generates sequences from vast data, capturing short and long-term-structures, and meaning.
* It improves based on context, guided dialogue, and tools, enhancing capabilities.
* AI is becoming a fundamental infrastructure/utility, equivalent to electricity, water, and gas. The trend is to seamlessly integrate with current day-to-day activities.

### **Impact on Education in Agricultural Sciences**

* In five years' time, university in-person lectures will be obsolete. A student-tailored lecture will be equivalent to a nowadays YouTube video. The role of digital lecturers is feasible, teaching 24/7 in a personalised manner with a better performance than the average high-level academic.
* The content outcome of the current agricultural degree may become obsolete due to AI’s superior knowledge-base (i.e. *digital agronomist*). ***Encyclopaedical knowledge is void of value.*** Graduates risk being unfit/redundant when entering an AI-driven industry.
* Universities must either focus on practical skills **or** rigorous training (*first principles*) for the next generation of scientists.
* If tertiary *Education = networking + accreditation + knowledge*. Agricultural Sciences require no accreditation, and the cost of knowledge would be slashed to “computing cost” versus the current academic system.

### **Impact on Agricultural Research**

* Knowledge base of AI stems from the internet archive, making use of scientific journals (across different languages, decades of research disciplines, and countries)
* AI can scrutinise research, improving quality and reducing irreproducibility. It is able to conduct meta-analyses and evaluate scientific rigor (replacing citations as a proxy for quality and providing the required research on demand).
* AI serves as a baseline expert, preventing redundant research and scrutinising research questions.
* Higher efficiency on dollar invested in research. Speed of research delivery (digital products and extension) to be accelerated.
* Scientific journals will no longer be the repository of knowledge. Indirect citations (via AI’s query) may be a new metric of impact.

### **The Dawn of the Digital Agronomist**

* AI will outperform early career agronomists in advisory roles (broader knowledge base and access to on-farm data).
* The "digital agronomist" is powered AI-driven decision support tools by distinct players (trading, chemicals, research institutions).
* The digital agronomist is able to communicate (via MCP) with multiple software, AI models, and data sources. Every ag-professional will have the “digital agronomist” as a pair-expert, serving as a baseline for training and decision-making.
* Human agronomists may shift to coaching roles. Only experienced professionals can stay competitive as expert advisors over digital agronomist advice.
* Sales ($1 million +) will still require a human point of contact; lower-stake sales to be replaced. Soft skills, reputation and the ability to capitalise on this scenario will be the key-drivers of professional success.

### **Impact from inside the farm gate**

* AI reduces advisory costs using digital agronomists across the World.
* Standardization and open access to communication standards between data sources (APIs) are a must for unleashing the effective use of AI.
* AI enables effective monitoring of larger farm operations through integration and real-time analysis of the data that is already available. cuts labour costs.
* Agronomists may become coaches; AI biases pose risks.
* Farm managers will oversee the logistics, maintenance, and troubleshooting operations of different autonomous machines (10+ years). (A George Jetson sort of figure). Already the case in sugarcane plantations (e.g. Solinftec).
* AI will ensure that you have the best information to act with the best *Management* possible.

### **Impact on gate to market (trading companies, Logistics, Industrial Food Producers)**

* AI provides real-time market (and operational) data, increasing company leverage over farmers (if data is not protected).
* Forecast of product requirements (regional and farm-level) will be accessible to most players, allowing for logistical optimisation and distribution/sales cost reduction.
* Back-end staff in large global players will decrease due to efficiency gains.
* In the short term, a flourishing of digital services due to easier deployment (i.e. *smaller team requirement*) to extract, transform and load (ETL) solution. Currently, most of the data acquired/produced (e.g. satellite data, farm machinery) is not used to its full potential.
* In the long run, full machinery autonomy and facilitated decision-making may lead to unrestricted market consolidation, favouring large producers (corporate farming), on a movement similar to what occurred with the automotive industry with the assembly line in manufacturing.

### **Market competition (local and global analysis)**

* *Monopoly favours business. Competition favours the consumer.*
* Currently, there is a still a barrier (monopoly) to the knowledge of best agricultural practices. Hence, currently, the competition is – to a large extent – local.
* Monopoly of the utility providers? Monopoly of the digital AI?   
  Higher competition for commodity producers.
* AI universalises knowledge and intensifies global competition.
* Hence, AI may favour the urban population (consumers) via lower food prices but lead to a more competitive environment for agricultural producers.

### **Production Factors That Are Irreplaceable or Inalterable**

* The cost of labour per unit production will decrease. Land availability is inelastic. Access to capital is unique to each business and the trend is that more capital will be required to have an operation
* *Bill Gates largest land owner in the US*
* Yield = Genetic (via effective research and genotype allocation) x Environment x Management (via digital AI). Hence, *Environment* or *Land* is the most important asset.
* Value outside the farm gate: political stability, logistical costs, and cultivar access shape competitiveness.

### **Impact on Rural Communities and Rural Landscape**

* AI-driven automation reduces labour, potentially depopulating rural areas.
* AI potentially replaces all small-town jobs (bank clerk, supermarket clerk)
* Farm consolidation alters socio-economic dynamics.
* It could lead to new industrial agriculture models, new business models and changes in rural life are likely (FIFO farm worker, GAEC farming).

### **Farm Automation**

* Automation enables precision farming but widens tech gaps due to cost.
* Logistic control and farm operation management (e.g. Solinftec) .
* Smaller machinery reduces soil compaction; new pest control methods emerge (e.g. reliance on chemical control methods, Zasso, UV).
* Connectivity empowers AI but may reduce farmer autonomy. Such as in the Netherlands nitrogen reduction, tracing (ban on crops using specific herbicides).

### **Digital Ag Services**

* AI allows small teams to create actionable digital products from data.
* It reduces the cost and complexity of developing services.
* Multiple companies can offer stackable services, enhancing options.