



CAPACITY BUILDING FOR STOCK AND CROP IMPROVEMENT USING BIOINFORMATICS RESEARCH



Community Talks: Dirk Valkenburg

UHASSELT

KNOWLEDGE IN ACTION

vliruos

SHARING MINDS, CHANGING LIVES

How did our story get started?

Global Minds 2017 and project ideation

VLIRUOS JOINT 2020-2022

Global Minds 2023

VLIRUOS SI 2023-2025



UHASSELT

KNOWLEDGE IN ACTION

Standing upon the shoulders of giants

- Past collaboration between CenStat and ILRI
 - Paul Janssen and Luc Duchateau
- Past collaboration between CenStat and JKUAT & MOI.
 - Roel Braekers & Ziv Shkedy



When art meets science

Crossing National chicken purebreds



Mechelse koekoek



Poule de Bresse

The Cosmopolitan Chicken Project

A database of fully sequenced genomes of all the crossbreeds

GLOBAL MINDS I (VLIRUOS)

- 27% (WDI2018¹) of the Kenyan population lives in cities!
 - Good road network!
 - Good breeding infrastructures!
 - Good distribution centers!
- 25% of the chicken meat consumed is broiler chicken:
 - Conditioned breeding
 - Adjusted feed
 - Antibiotics



¹<https://datacatalog.worldbank.org/dataset/kenya-kenya-population-and-housing-census-2009-ipums-subset>

GLOBAL MINDS I

- 73% of the Kenyan population lives rural areas and remote villages. They rely on chicken meat from endogenous jungle fowls



Problem statement

- Can we increase the protein content in the diets of rural communities by increasing:
 - Chicken meat yield
 - Chicken eggs yield
- Challenge:
 - Indigenous chicken have deserved their place in the rural area. Commercial strains will not survive the various environmental stress factors.
 - Commercial species are domesticated to optimize protein yield, but they require a constant supply of feed.

Stakeholder: JKUAT



Sheila Cecily Ommeh

JKUAT hosts the genome database of Chinese chicken



“We want to construct a bioinformatics minor trajectory in our master programme at the Institute for Biotechnology Research”

Jomo Kenyatta University of Agriculture and Technology

Stakeholder: ILRI



Olivier Hanotte

The University of Nottingham
International Livestock Research Institute

ILRI hosts the
genome database of
African chicken



“A lot of data, not
much human
capacity to handle
the data”

Stakeholder: Koen Vanmechelen



A database of fully sequenced genomes of all the crossbreeds

“a new ‘cosmopolitan genome’ to the local flock puts an end to the ongoing cycle of genetic erosion.”

The Cosmopolitan Chicken Project

Solution



Correlate genetic variations in the chicken DNA to phenotypic traits such that an informed decision on a breeding program can be made.



Knowledge gap in Applied statistics and hands-on bioinformatics

BIRD:

Directed **B**reeding Programs for **I**mproved Poultry Livestock by
Genetic Bioinformatics **R**esearch and **D**evelopment in Kenya

Objective I:

Establish a centre of excellence in
bioinformatics skill and infrastructure



Objective II:

Install an infrastructure to combine the
African, **C**hinese and **C**osmopolitan
Chicken genomic data in one
repositories entitle AC3PO:



Funding of phase 1 activities

- Workshops in Nairobi with 10 scholarship from rural regions
 - GWAS by Alejandro Correa Rojo August 2022
- Course development activities in Nairobi
- Train-the-trainer
- Research link between UHasselt & JKUAT/ILRI
- Infrastructure

Funding of phase 1 investment

- Investments:
 - Server to host AC-3PO
 - New computer room with 30 laptops
- Staff:
 - 50% ICT support
 - 100% Liaison officer
 - Research
 - Oversee ICT
 - Link between ILRI/JKUAT and UhasseLT
- Dissemination:
 - Website
 - Scientific papers
 - Closing event with launch AC-3PO
 - Ministries (health, fisheries and agriculture)
 - Local stake-holders

Workshops

May 2022: Workshop on population genetics and SNP detection workflows together with ITG, Highwoods, JKUAT (Grace Kennedy), CIM (José, Hereirra, Havana, Cuba).

June 2022: train-the-trainer event on the VSC. (Stephen Ogada)

September 2022: Workshop on bioinformatics workflow for next-generation sequencing and population genetics.



Computer room



**CLOSE
THE
GAP**
BRIDGING
THE DIGITAL
DIVIDE

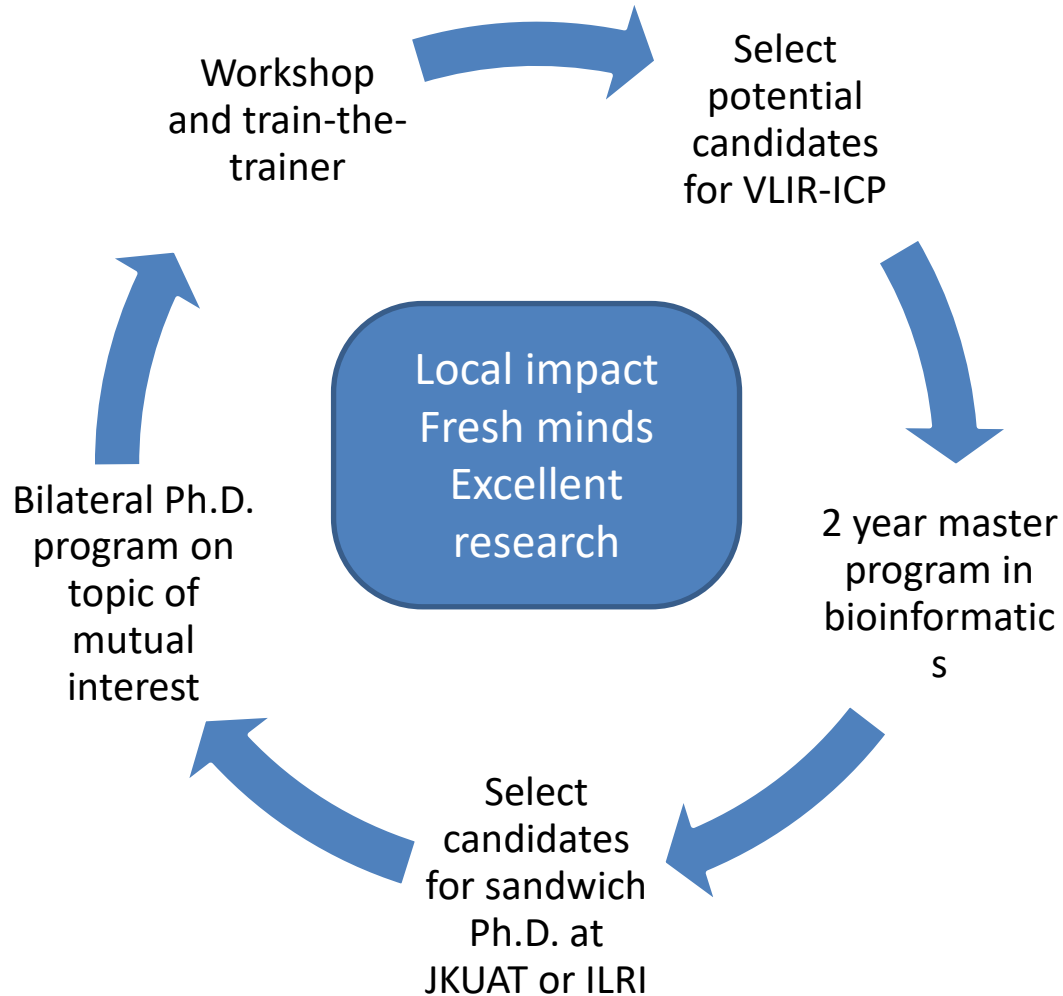
Lessons learned!



Lessons Learned!



Impact: Wheel of sustainable research collaboration



GLOBAL MINDS II (VLIRUOS)

- Verify the computer room
 - Lessons learned → include tech support to safeguard the computer room.
- Boots on the ground
- Extensions to other crops >> Climate change
- Climate change will affect food accessibility and cash inflow.
- Nurseries:
 - Banana (JKUAT) & Coffee seedlings (KALRO)
- Sustainable agriculture:
 - Doum Palm & Slender leaf



Workshops on AI in precision agriculture



MoU



C-BIRD:

Tackling **C**limate change-based food and economic instability in rural regions by directed crop and poultry **B**reeding programs for **I**mproved genetic bioinformatics **R**esearch and **D**evelopment in Kenya (C-BIRD)

Objective I:

Expand BIRD project from poultry to cash and staple crops

Objective II:

Expand infrastructure to meet rising demand



Staple Crops



Doum palm, slenderleaf

Cash Crops

Bananas
Coffee



**Kenya Agricultural and
Livestock Research
Organization**



3 Workshops & course development



Investment in compute



Train-the-Trainer



Opening and closing of the academic year, proposal writing, and intense training:

VLAAMS
SUPERCOMPUTER
CENTRUM



Vlaanderen
is supercomputing

Impact: Developing Sleeping Technology



The Impact Licensing Initiative

Societal Impact with Technology

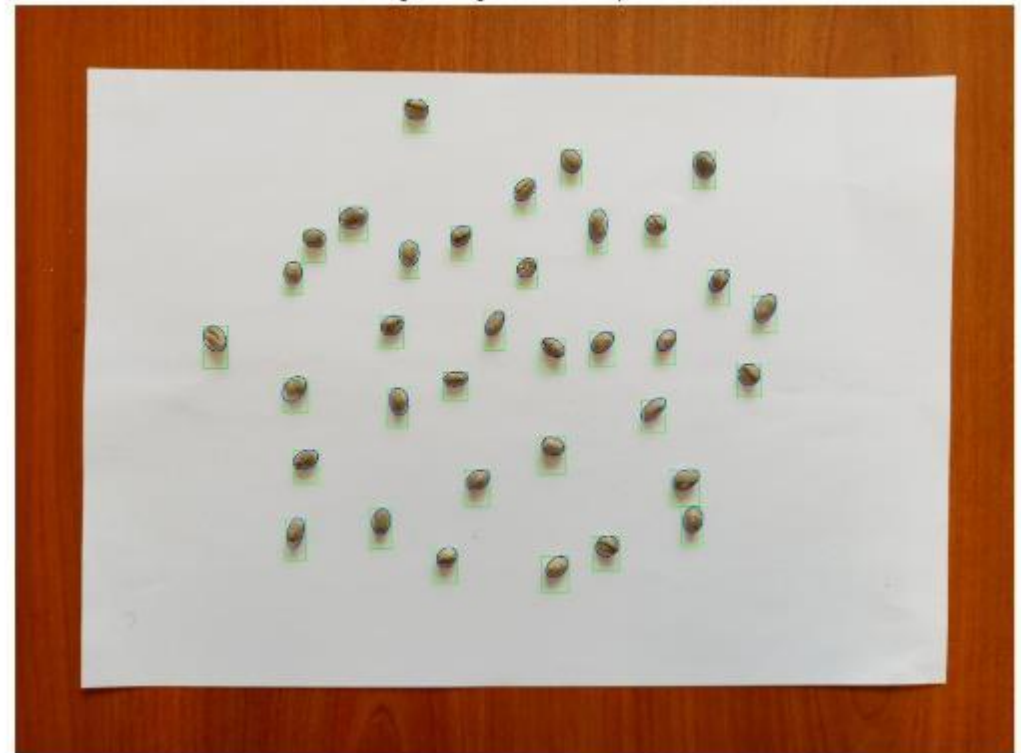
The Impact Licensing Initiative (= ILI) is a catalyst for technology owners to create impact at scale on the sustainable development goals (=SDG's). ILI starts from the observation that there are many technologies still under development that could solve the global societal challenges of today and tomorrow.

[MORE INFO](#)

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Food Provenance

Original Image with Fitted Ellipses



- Funding phase 1 (BiRD) and 2 (C-BiRD):
 - Building capacity at JKUAT by investments in computing infrastructure and bright minds!
 - Each workshop is embedded in the curriculum
 - Extension to other scientists
- Funding phase 3:
 - VLIRUOS SI project Sea-BiRD to use the capacity for research and extend to Kisumu region for blue economy (Nikol Kmentova and Maarten Vanhove)
 - Impact Licensing Initiative → strengthens coffee chain and expand to other crops/products
 - Sustainably establish the center of excellence in the region without VLIRUOS support
- Funding phase 4:
 - VLIRUOS Teams on preliminary crossbreeds and field trials
- Funding phase 5:
 - Translational activities and bringing the breed to the villages with ILI and Directorate of Extension and Technology Transfer of JKUAT

- UHasselt Magazine:

<https://www.uhasselt.be/nl/over-uhasselt/magazines/uhasselt-magazine>

- Het Belang van Limburg:

https://www.hbvl.be/cnt/dmf20230608_93849252

- JKUAT:

<https://www.jkuat.ac.ke/jkuat-hasselt-university-train-on-bioinformatics/>

<https://www.jkuat.ac.ke/varsity-staff-and-post-graduate-students-trained-in-bioinformatics-and-ai/>

<https://www.jkuat.ac.ke/jkuat-unveils-bioinformatics-lab-to-drive-genetic-research-and-innovation/>

REAL IMPACT? CBA!!!!



Combat the lack of diversity and openness

Sheila Ommeh (BiRD) & Johnstone (C-BiRD)



Coming soon: Sea-BiRD