

# Strategic & Competitive Intelligence in precision agriculture



JUMP TEAM :

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Antonio Di Tommaso  
Marco Ciompi  
Pasquale Gorrasi*

# JUMP TEAM

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**MARCO CIOMPI**

Background in *Business Administration*

**ANTONIO DI TOMMASO**

Background in *Computer Science*

**ALESSANDRO ANDRIOTTO**

Background in *Economics and Management*

**PASQUALE GORRASI**

Background in *Finance*



# AGENDA

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❖ WHAT ARE THE GOALS OF THE PROJECT ?

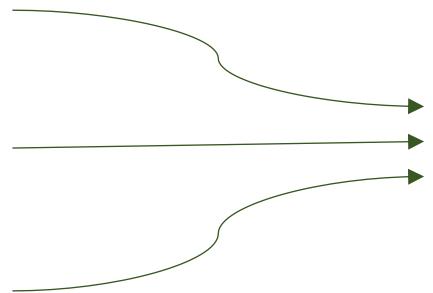
❖ WHAT ARE THE RESEARCH QUESTIONS ?

❖ RESEARCH QUESTION 1

❖ RESEARCH QUESTION 2

❖ RESEARCH QUESTION 3

❖ CONCLUSIONS



1. CONTEXT
2. METHODOLOGY & WORKFLOW
3. ANALYSIS
4. DISCUSSION & INSIGHT



# CONTEXT & PROJECT GOALS



IT IS A MANAGEMENT STRATEGY THAT EXPLOITS **DATA** TO SUPPORT MANAGEMENT DECISIONS TO IMPROVE RESOURCE USE EFFICIENCY, PRODUCTIVITY, QUALITY, PROFITABILITY AND SUSTAINABILITY OF AGRICULTURAL PRODUCTION

FIND OUT CURRENT **TECHNOLOGIES** AND EMERGING **APPLICATIONS**

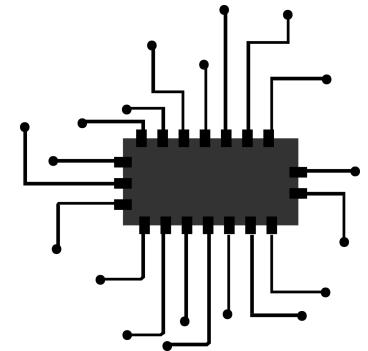
PRECISION AGRICULTURE **MARKET** ANALYSIS  
FOCUSING ON SOME START-UPS

# **RESEARCH QUESTIONS 1**

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**WHAT ARE THE TECHNOLOGIES AND THE  
EMERGING APPLICATIONS IN PRECISION  
AGRICULTURE? WHICH ACTORS, COUNTRIES, ETC.**



# CONTEXT

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## SOCIAL CHANGES

Take care of Earth and minimize soil pollution



## AGRICULTURE 4.0

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## TECHNOLOGICAL DEVELOPMENT

i.e. IoT, IT and Big Data

INNOVATIVE PRODUCTS ARE PROTECTED BY **PATENTS**



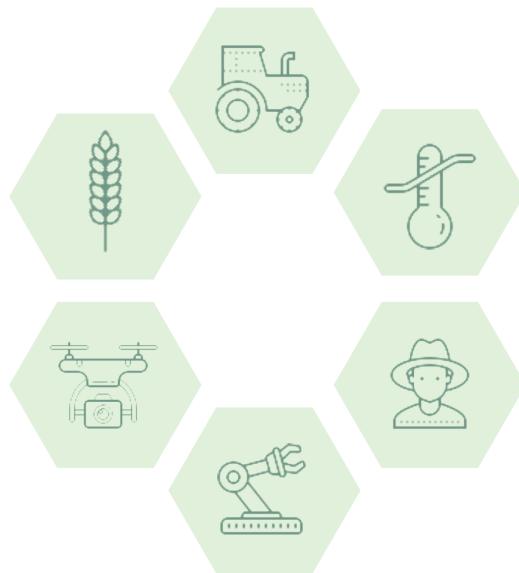
# RQ1A & RQ1B

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WE DECIDED TO FOLLOW TWO DIFFERENT APPROACHES  
IN ORDER TO FIND AFFIRMED TECHNOLOGIES AND  
EMERGING APPLICATIONS

*RQ1A*

AFFIRMED TECHNOLOGIES

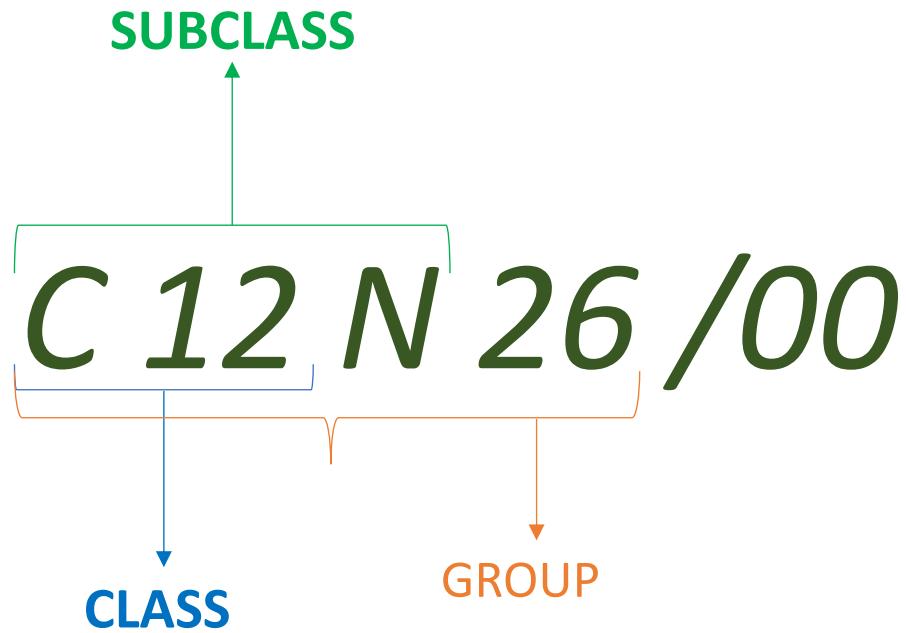


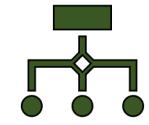
*RQ1B*

EMERGING APPLICATIONS

# IPC CODE

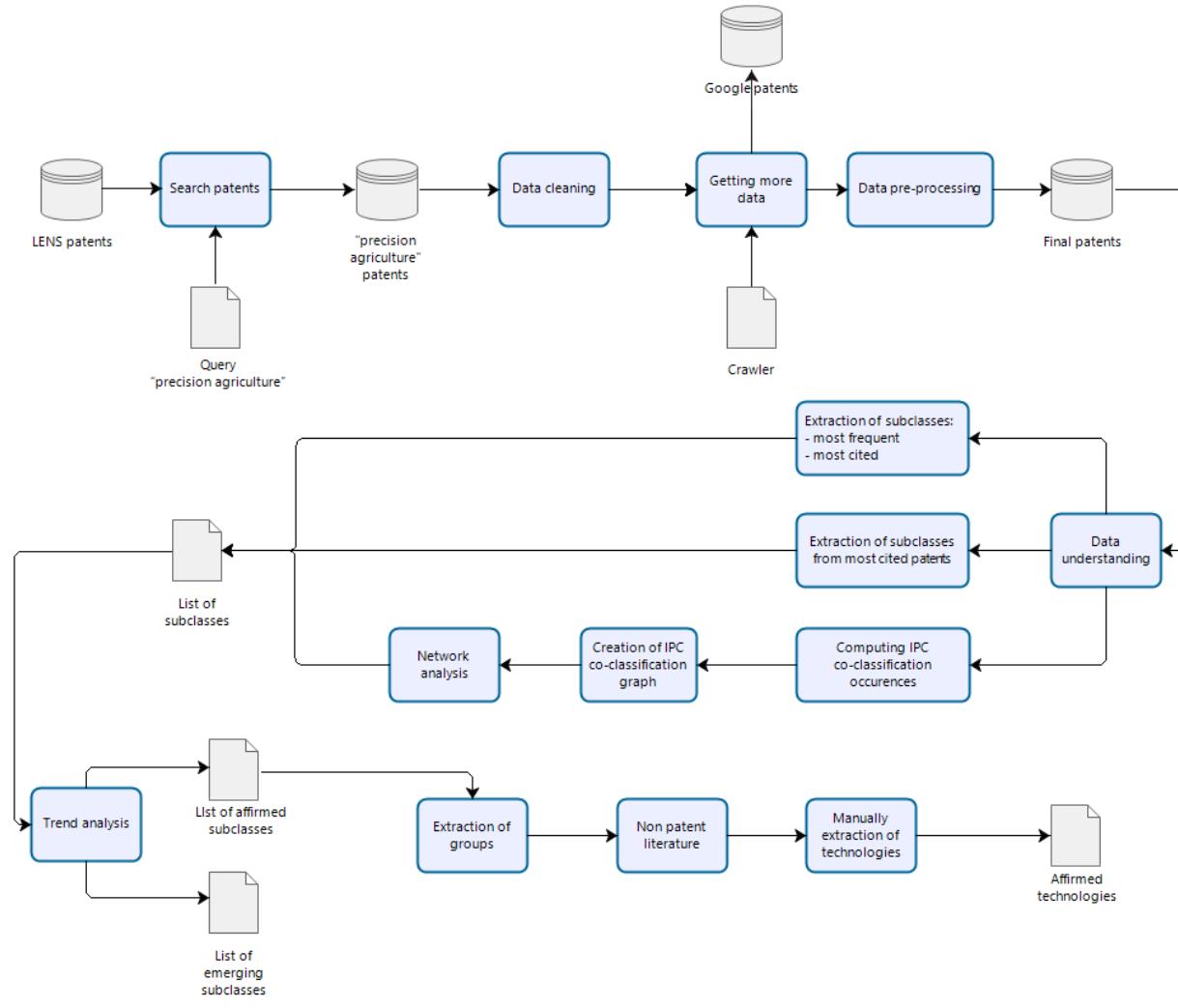
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# METHODOLOGY FOR AFFIRMED TECH

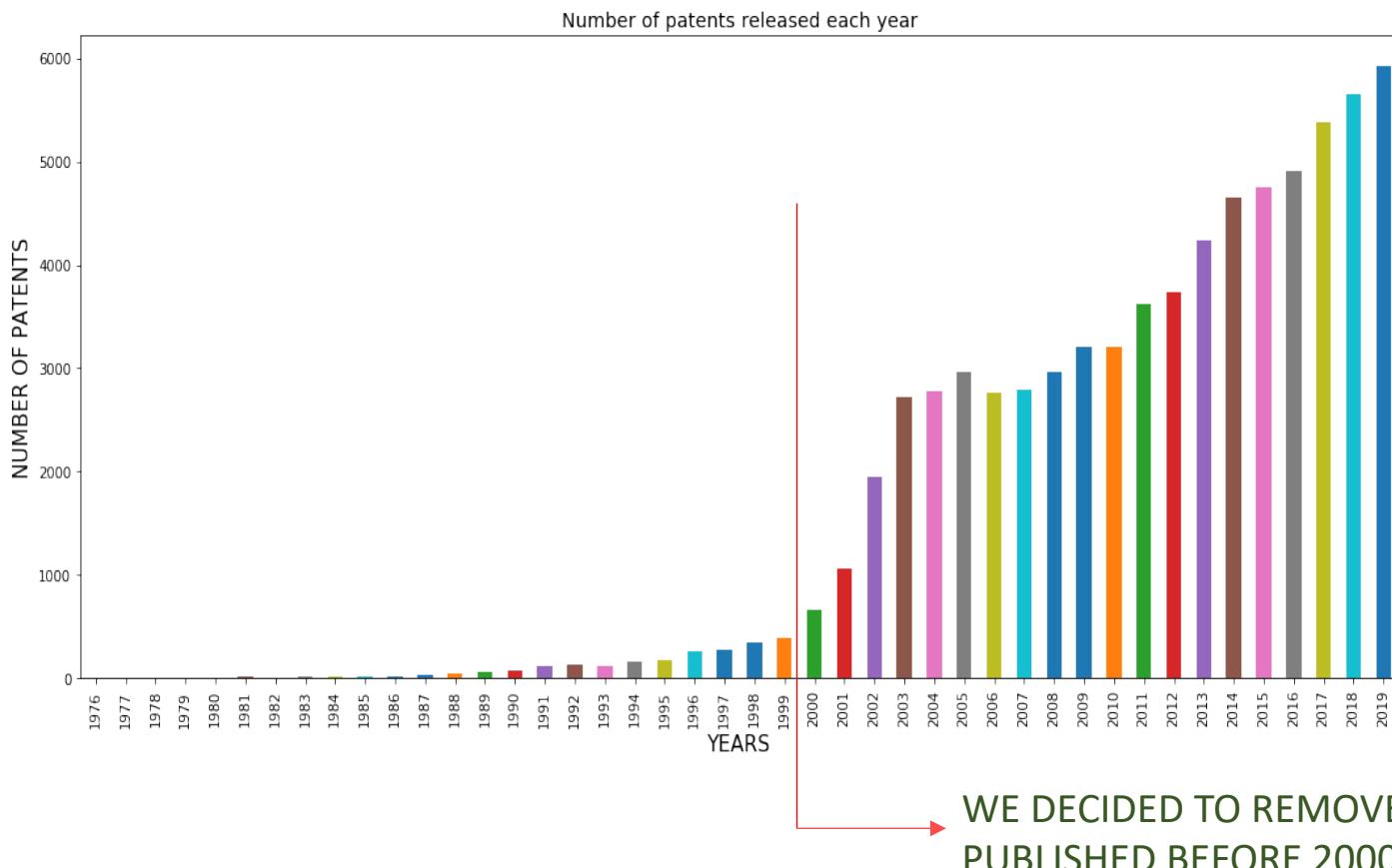
RQ1A



# ANALYSIS

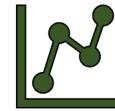


RQ1A



*THE NUMBER OF PATENTS INCREASES  
IN THE MOST RECENT YEARS*

# ACTOR & COUNTRY ANALYSIS

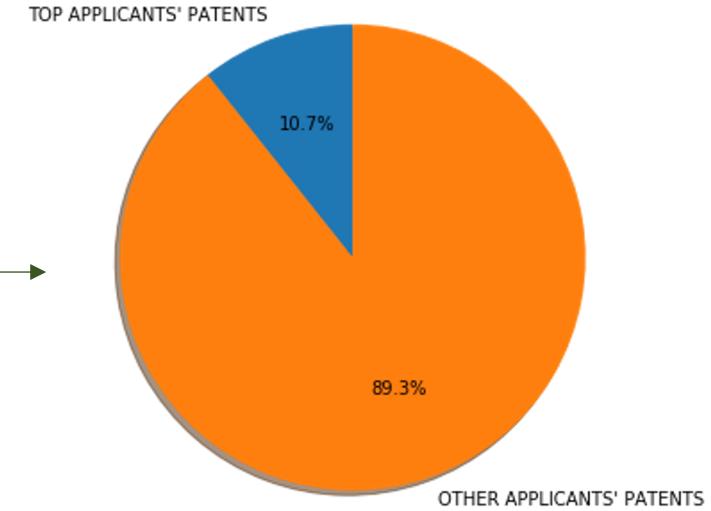


LONG TAIL DISTRIBUTION  
TO SELECT AN APPROPRIATE  
NUMBER OF APPLICANTS

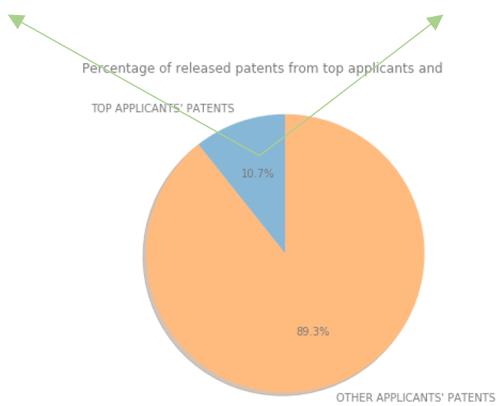
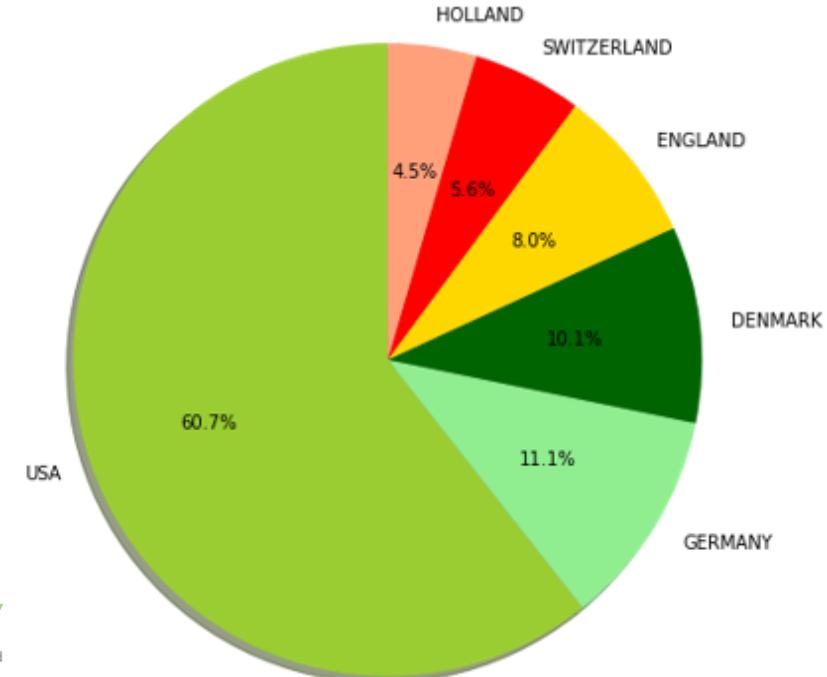
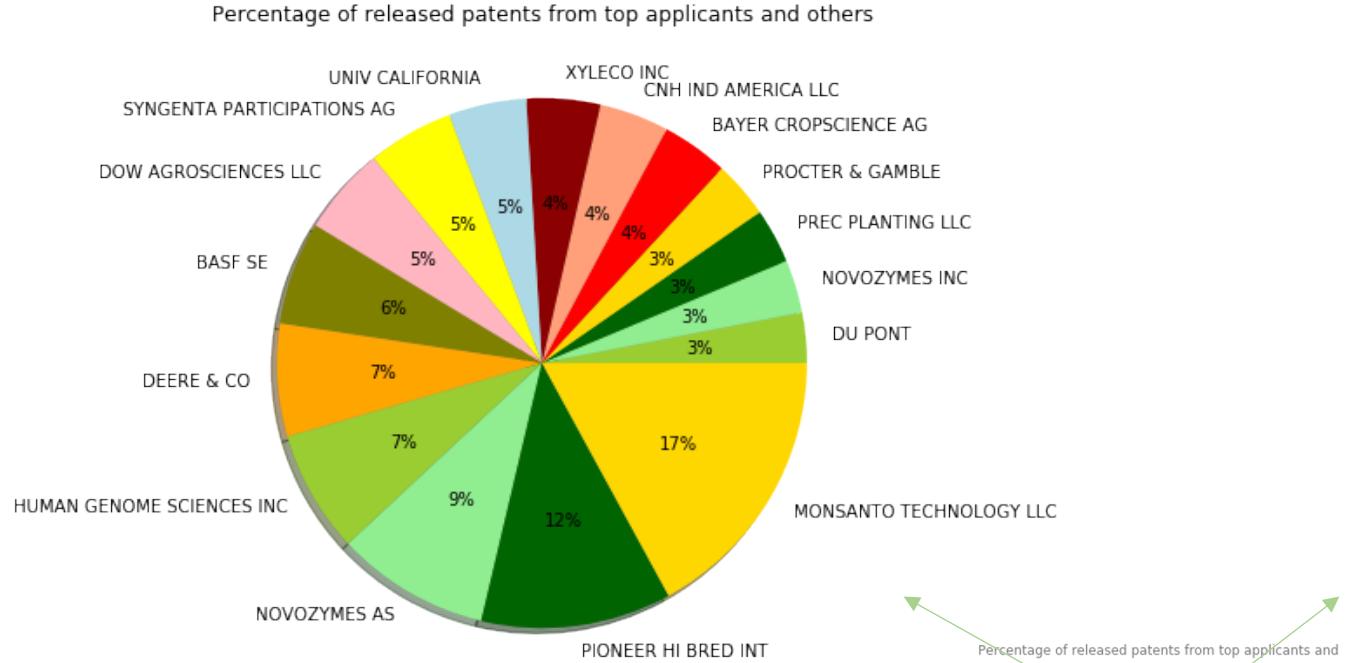


APPLICANTS THAT  
RELEASED FEW PATENTS  
ARE IRRELEVANT FOR  
OUR ANALYSIS

Percentage of released patents from top applicants and others



# ACTOR & COUNTRY ANALYSIS

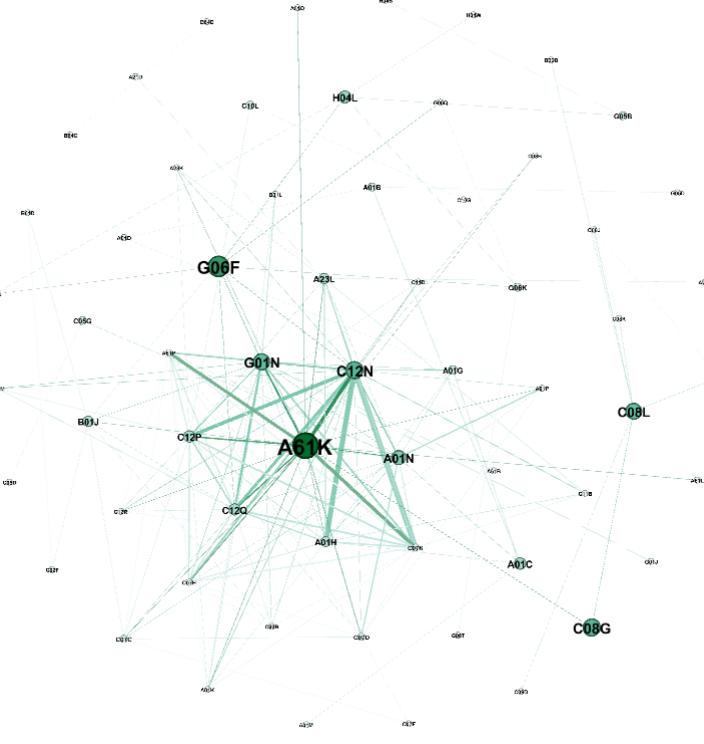


# TECHNOLOGICAL SECTOR

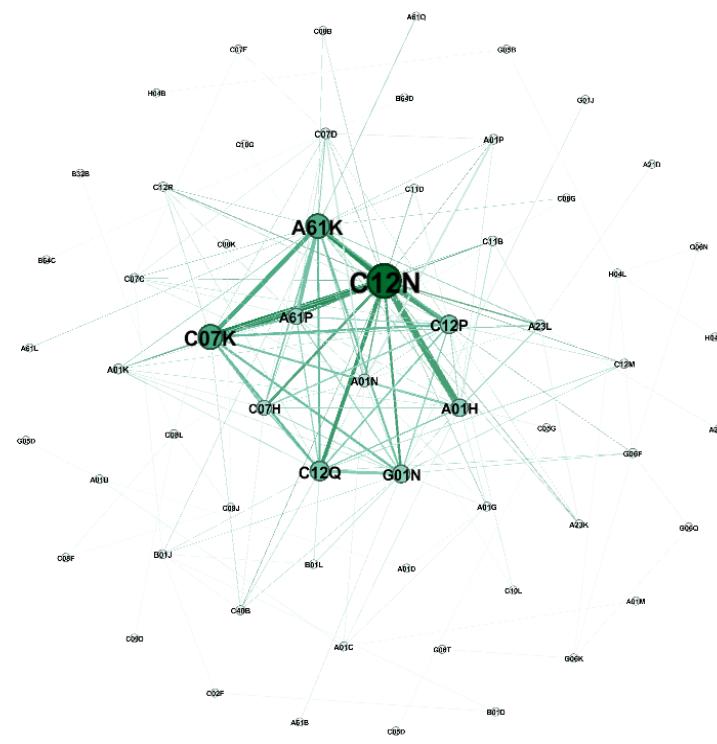


THREE APPROACHES:

- 1) MOST FREQUENT AND MOST CITED SUBCLASSES
- 2) SUBCLASSES BELONGING TO THE MOST CITED PATENTS
- 3) NETWORK ANALYSIS BASED ON THE OCCURRENCES OF CO-CLASSIFICATION

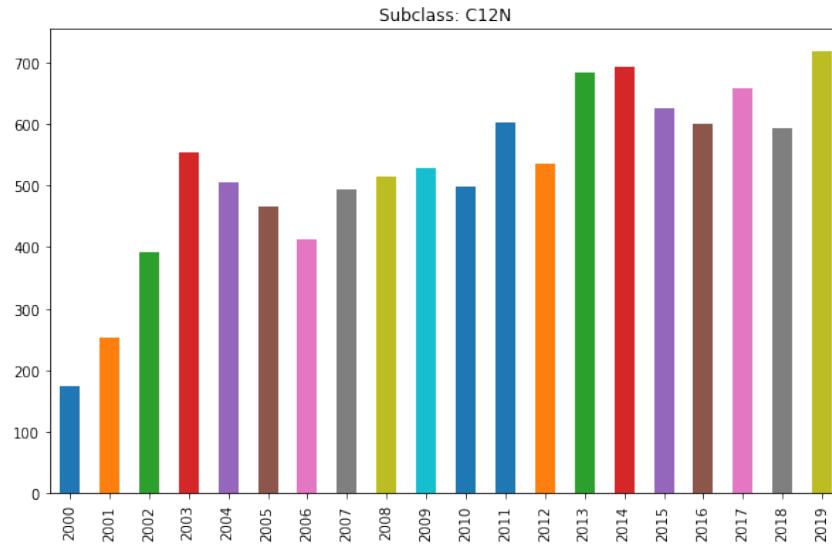


Network analysis with betweenness centrality



Network analysis with centrality degree

# TREND ANALYSIS

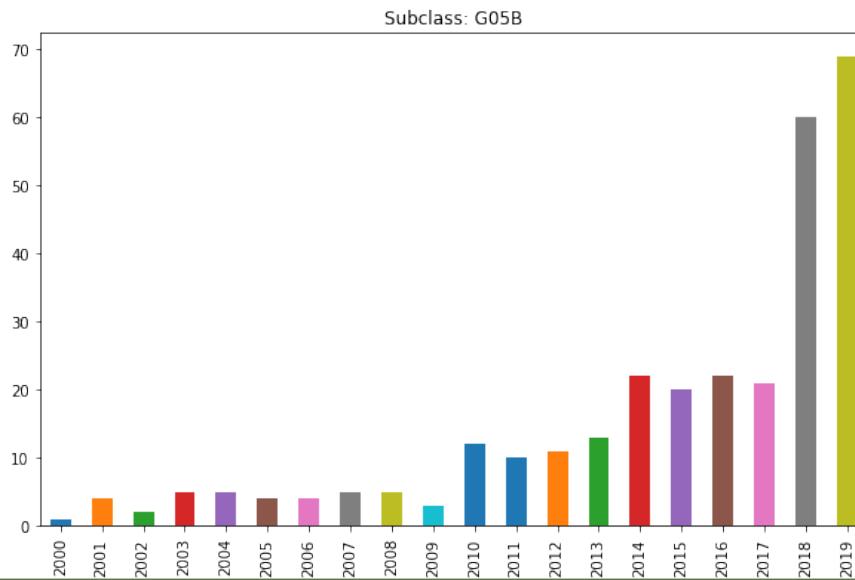


## EXAMPLE OF EMERGING TECHNOLOGICAL SECTOR TREND

*G05B : “control or regulating system in general”*

## EXAMPLE OF AFFIRMED TECHNOLOGICAL SECTOR TREND

*C12N : “microorganisms or enzymes compositions thereof biocides, pest repellents or attractants, or plant growth regulators”*



# AFFIRMED TECHNOLOGIES



*BIOCIDES*

*PESTICIDES*

*SOWERS*



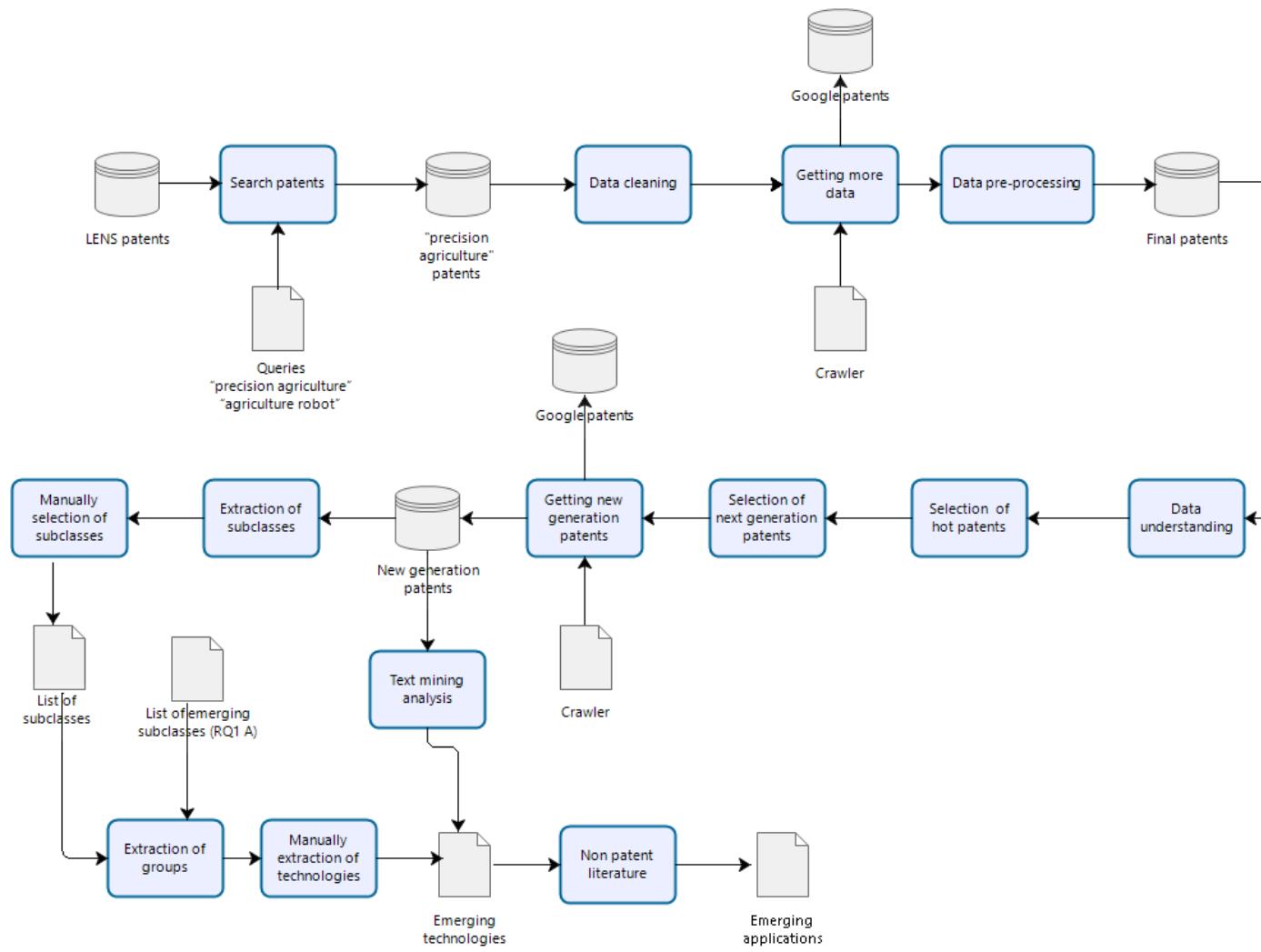
*MOWERS*

*SHAKERS*

*COMBINED HARVESTERS*

# METHODOLOGY FOR EMERGING APPLICATIONS

RQ1B



# ANALYSIS FOR EMERGING APPLICATIONS



RQ1B

## NEXT GENERATION PATENTS

WHAT ARE THE TECHNOLOGIES THAT THESE PATENTS TALK ABOUT?

$$threshold = \left( -\frac{1}{80} \right) * age\_of\_patent + \frac{5}{8}$$



FINAL PATENTS

## TEXT MINING ANALYSIS

MOST FREQUENT TRIGRAMS FROM TITLE AND ABSTRACT

TECHNOLOGIES PATENTS TALK ABOUT

I.E. WIRELESS POWER, DATA  
PREPROCESSING SYSTEMS  
AEROSOL DELIVERY SYSTEMS

## SUBCLASSES ANALYSIS

SUBCLASSES FOR THE NEXT GENERATION PATENTS

LONG TAIL DISTRIBUTION

LIST OF SUBCLASSES

LENS CLASSIFICATION EXPLORER

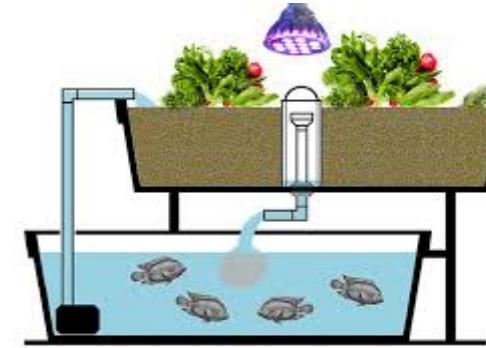
# EMERGING APPLICATIONS



*HYDROPONIC*



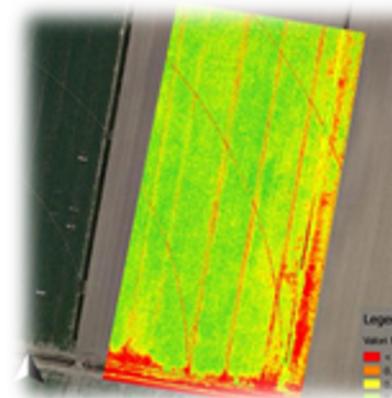
*AQUAPONIC*



*DRONES*



*VIGOR MAP*



## **RESEARCH QUESTION 2**

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**IDENTIFY COMPETITORS AND  
POTENTIAL PARTNERS OF VITIBOT  
THROUGH PATENT LANDSCAPE ANALYSIS**



# CONTEXT



## BAKUS



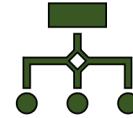
## PATENT LANDSCAPE

WHAT ARE THE MOST INTERESTING TECHNOLOGIES COMPOSING BAKUS?

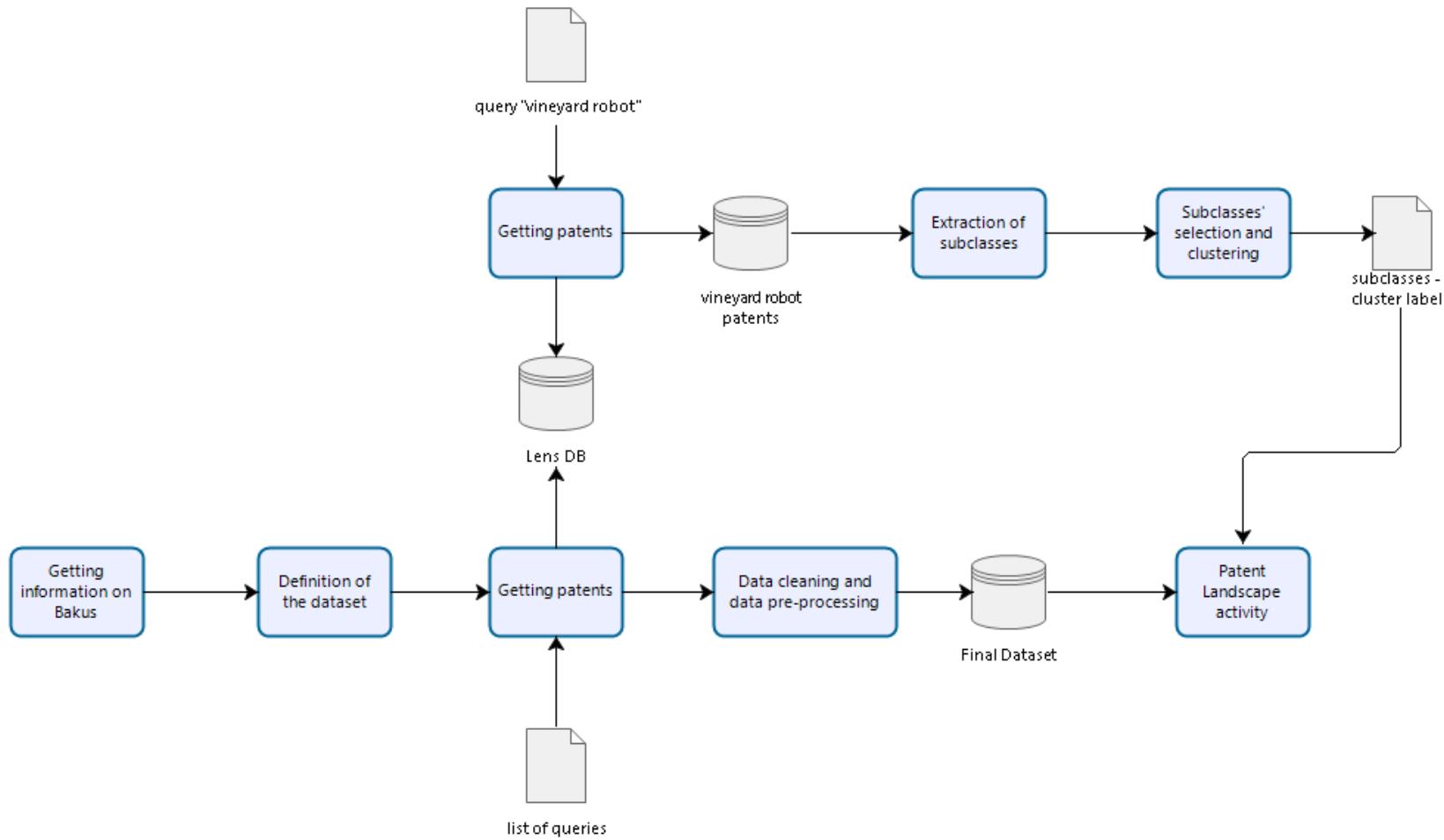
FIND OUT WHICH COMPANIES ARE INVESTING IN THE SAME TECHNOLOGICAL FIELD

COMPETITORS

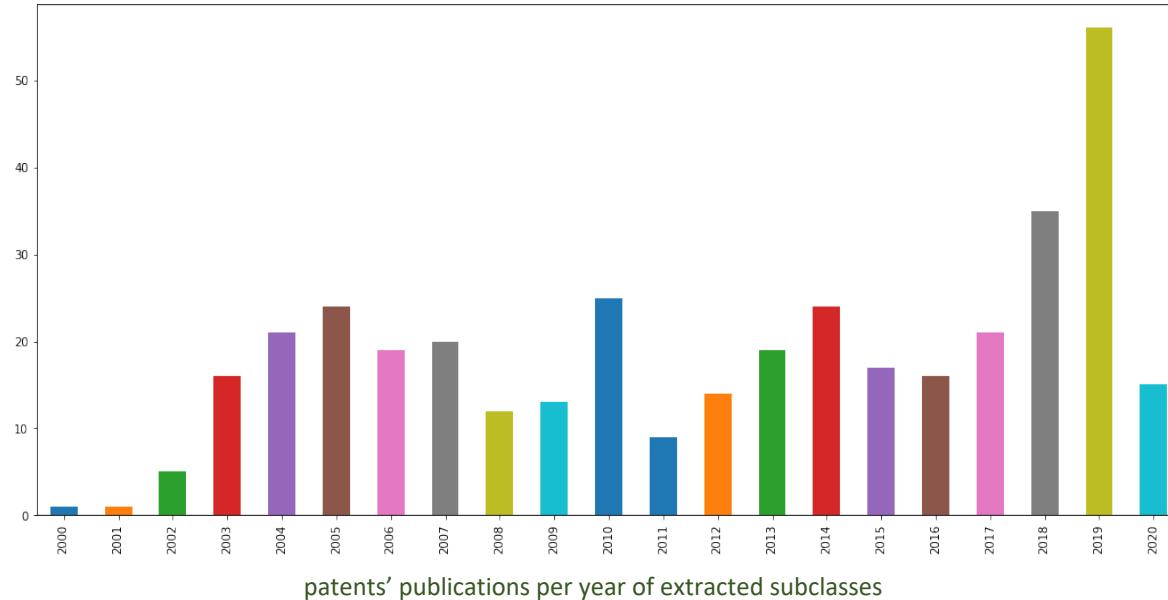
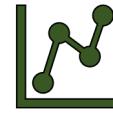
POTENTIAL PARTNERS



# METHODOLOGY

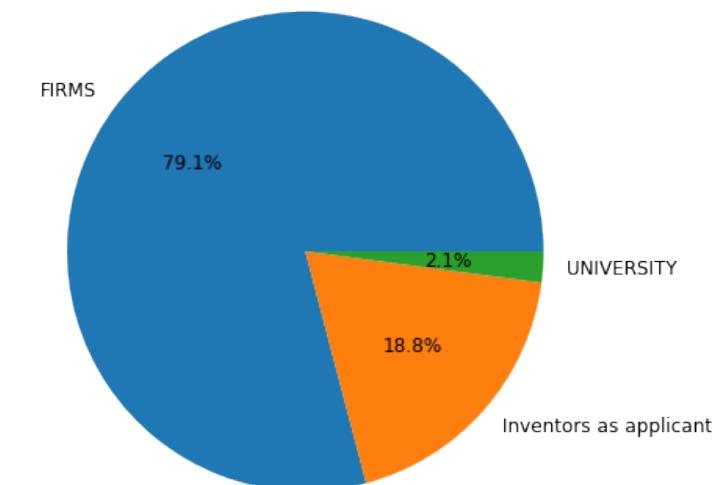


# ANALYSIS



PATENTS' PUBLICATIONS ABOUT BAKUS TECH FIELDS HAS BEEN INCREASING YEAR BY YEAR

Percentage of patents released from applicants' types



WHO IS INVESTING IN THIS INDUSTRIAL SECTOR?



# ANALYSIS



## LIST OF TOP 10 APPLICANTS FOR PUBLICATIONS

| FIRM                            | PRODUCT  |
|---------------------------------|--|
| BAYER CROPSCIENCE               | Pesticides, fertilizers, insecticides  |
| ADVANCED ELEMENTAL TECHNOLOGIES | Computing-based patents/products   |
| APPLIED MATERIALS INC           | Equipment, services and software to produce semiconductor chips for electronics, flat screen displays for computers, smartphones, televisions and solar products |
| INDIGO AG INC                   | Plant microbes, to improve the yields of cotton, wheat corn etc  |
| ANDERSON NOEL WAYNE             | Is an inventor for deere & co firm   |
| LAW OFFICE OF J. GROSS          | Law office   |
| GOOGLE INC                      | Simply Google  |
| WEEDOUT LTD                     | Bioherbicides  |
| CRINKLAW FARM SERVICES INC      | Custom vineyard services   |
| DEERE & CO                      | Agricultural machines  |

## UNPACKING PROCEDURE

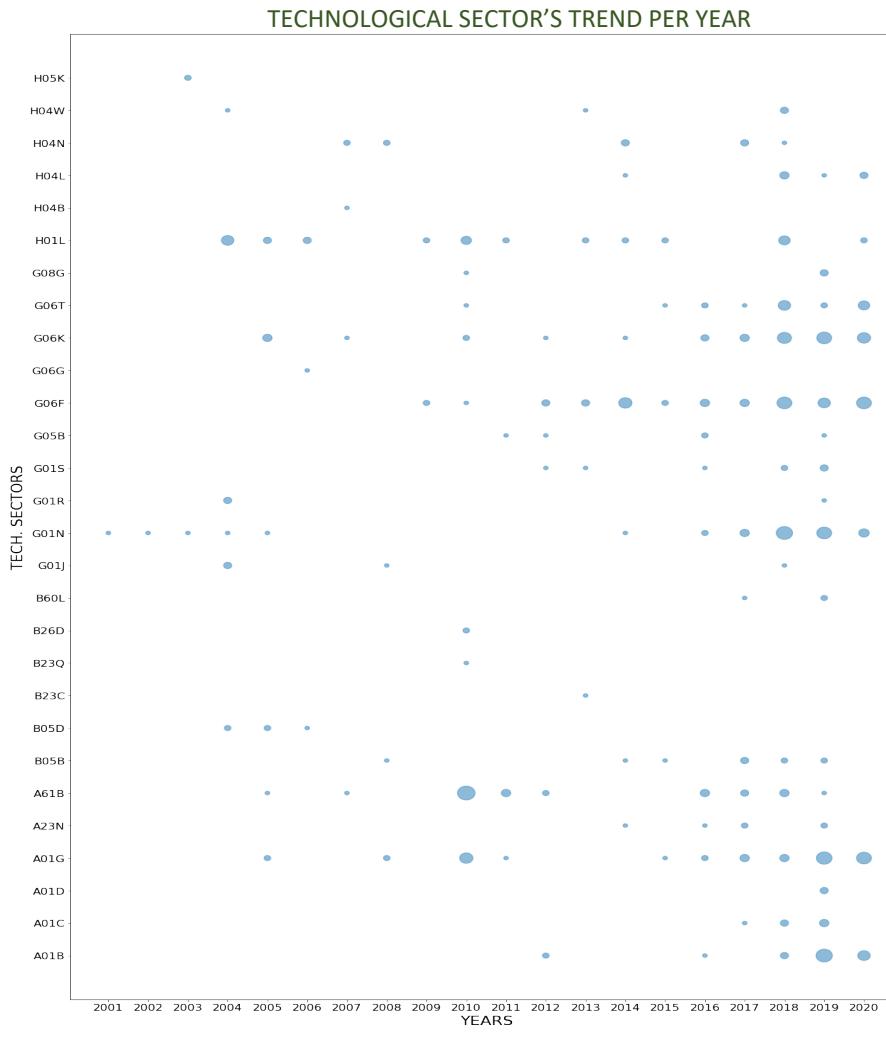
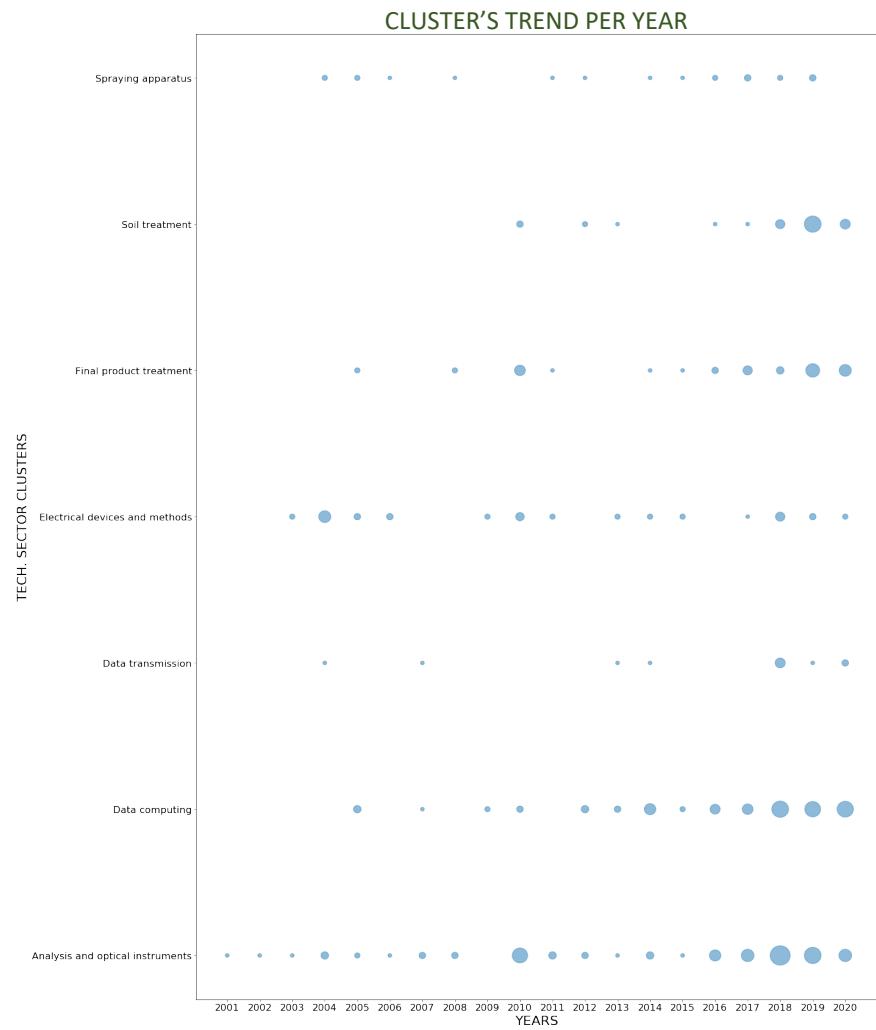
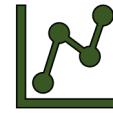


UNPACKED DATASET WITH ONLY RECORDS BELONGING TO THE SELECTED SUBCLASSES, AND CLUSTER THEM TOGETHER



## BUBBLE CHARTS

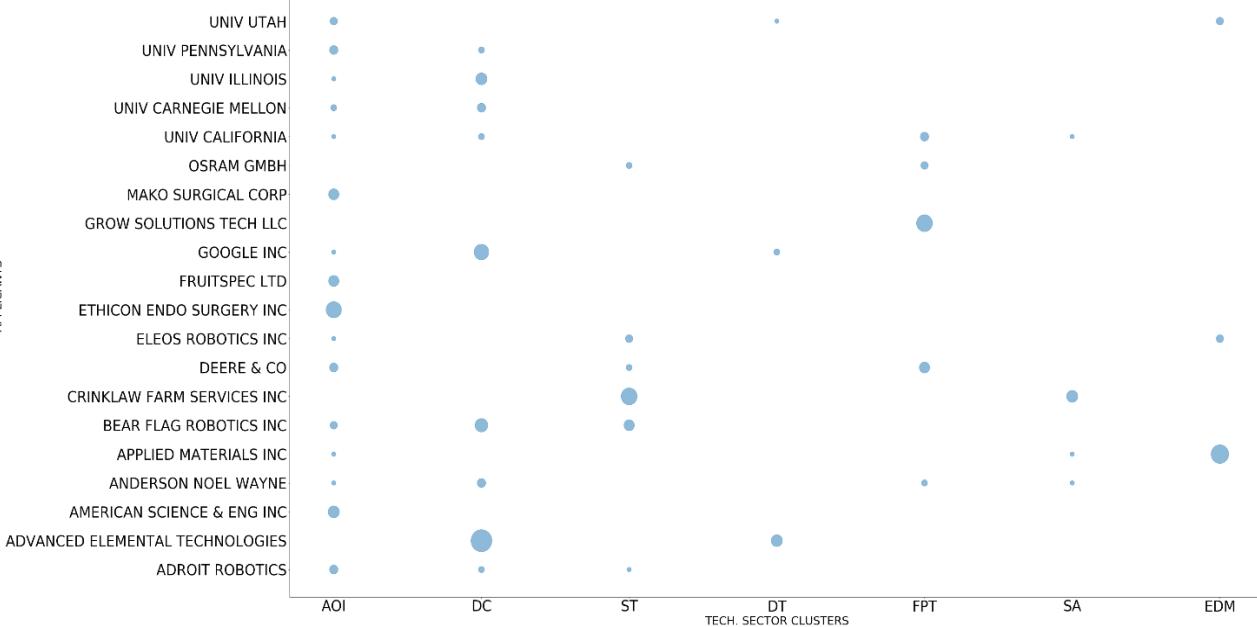
# ANALYSIS



# ANALYSIS



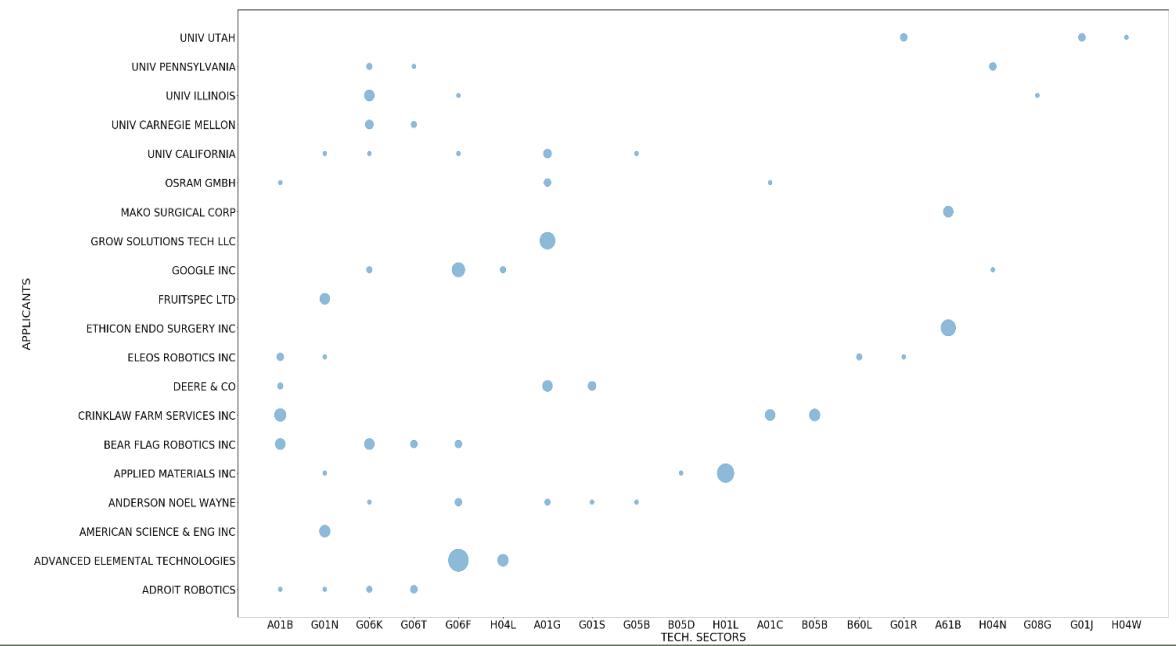
APPLICANTS



TOP APPLICANTS/ TECHNOLOGICAL SECTORS  
BUBBLE CHART



APPLICANTS



# DISCUSSION & INSIGHT

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## POTENTIAL COMPETITORS

- Deere & Co and Case New Holland
- Bear Flag Robotics Inc
- Fruitspec LTD
- Eleos Robotics INC

## POTENTIAL PARTNERS

- Adroit Robotics
- Advanced Elemental Technologies
- Applied Materials Inc
- GrowTech Solutions

## **RESEARCH QUESTION 3**

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**ANALYSE THREE STARTUPS WORKING IN  
PRECISION AGRICULTURE TO UNDERSTAND  
THEIR POSITIONING IN THE MARKET, IF  
THEY ARE COMPETITORS, IF THEY  
COLLABORATE OR COULD COLLABORATE**



# CONTEXT

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*"MEETING THE CHALLENGES OF  
SUSTAINABLE VITICULTURE"*

VITIBOT HELPS WINEGROWERS  
TO FACE UP ECONOMICAL,  
ENVIRONMENTAL AND SOCIAL  
CHALLENGES

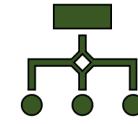


VINBOT BOOST THE  
QUALITY OF EUROPEAN  
WINES BY IMPLEMENTING  
PRECISION VITICULTURE TO  
ESTIMATE THE YIELD

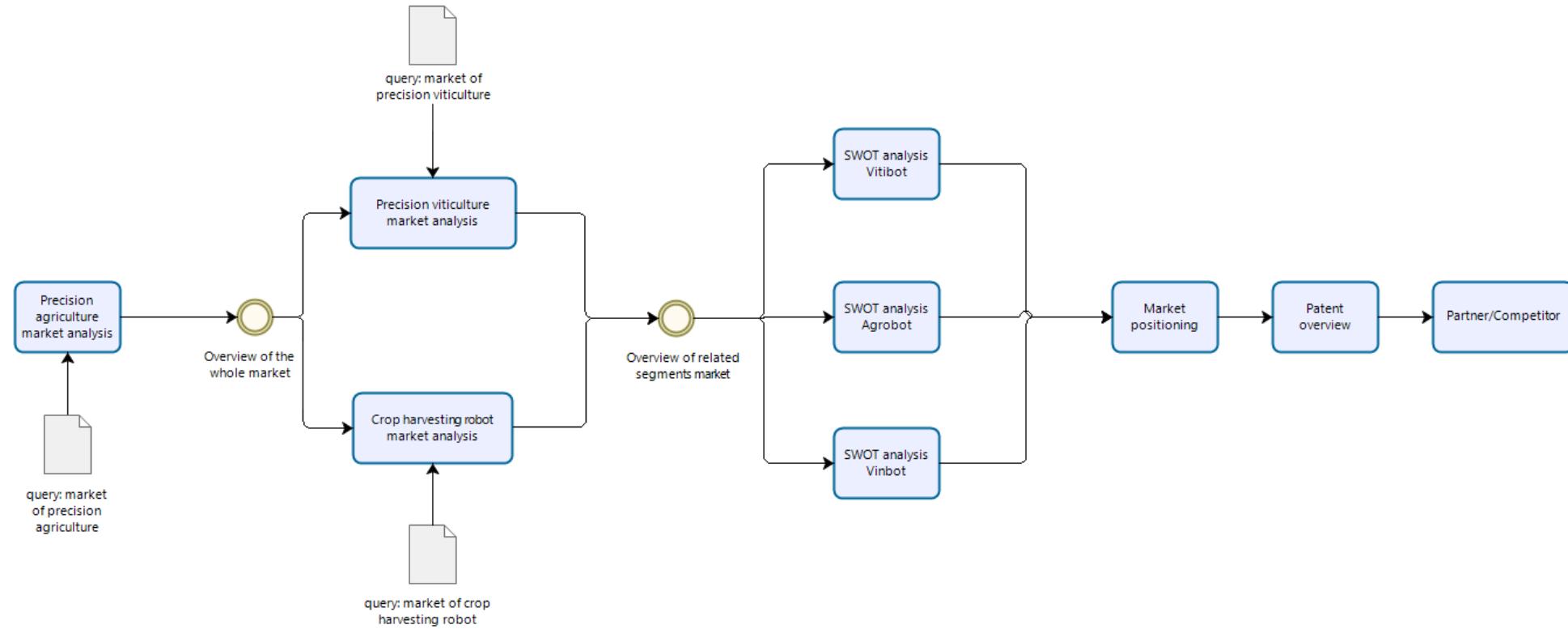


AGROBOT HAS DEVELOPED THE FIRST  
PRE-COMMERCIAL ROBOT FOR  
GENTLY HARVEST STRAWBERRIES,  
NO MATTER WHERE AND HOW THEY  
ARE GROWN

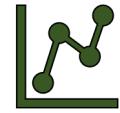




# METHODOLOGY

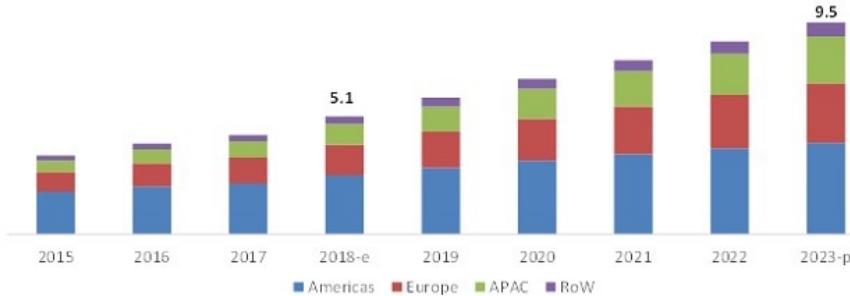


# ANALYSIS OF THE OVERALL MARKET



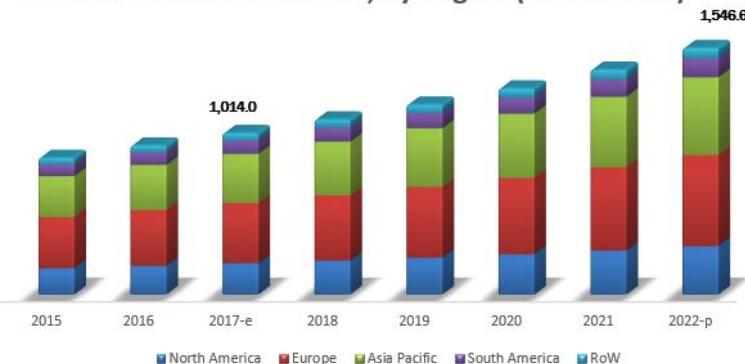
## PRECISION AGRICULTURE MARKET

PRECISION FARMING MARKET, BY REGION (USD BILLION)



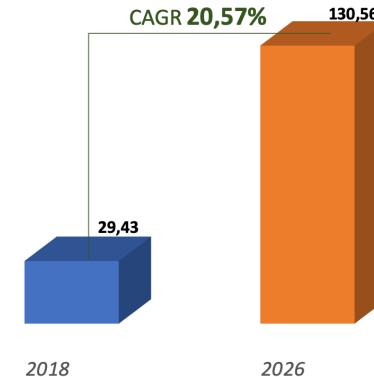
## PRECISION VITICULTURE MARKET

Precision Viticulture Market, by Region (USD Million)



## CROP HARVESTING ROBOT MARKET

Crop harvesting Robot market (USD Million)



# VITIBOT SWOT ANALYSIS



## STRENGTHS

- ❖ HIGHLY QUALIFIED TEAM
- ❖ BAKUS DESIGNED WITH INTERNAL TECHNOLOGY
- ❖ MATCH WITH MARKET NEEDS
- ❖ ALL KIND OF WINEYARDS
- ❖ SEVERAL PATENTS
- ❖ BAKUS PRICE COMPARED WITH CONVENTIONAL TRACTOR

## WEAKNESSES

- ❖ IT CAN'T BE SELF-FINANCING
- ❖ BAKUS IS STILL AT THE EXPERIMENTAL STAGE AND ONLY 6 ROBOT HAVE BEEN MANUFACTURED
- ❖ LACK OF HISTORICAL DATA
- ❖ LIMITED PRODUCT PORTFOLIO, NOT YET IN COMMERCE

## OPPORTUNITIES

- ❖ IT IS OPERATING IN A FAST GROWING MARKET
- ❖ FEW COMPETITORS IN FRANCE
- ❖ GROWING DEMAND IN VITICULTURE SECTOR
- ❖ RECENT AWARDS IS MAKING THE COMPANY WELL-KNOWN
- ❖ POSSIBILITY TO GET EU'S CONTRIBUTIONS
- ❖ CHANCE TO FORM PARTNERSHIP WITH BIG COMPANIES

## THREATS

- ❖ COMPETITIVENESS IS EXPECTED TO GROW IN EUROPE
- ❖ SMALL BUSINESSES CAN'T AFFORD BAKUS
- ❖ LACK OF TECHNICAL INFRASTRUCTURE AND LOCAL EXPERTS
- ❖ TECHNOLOGICAL BACKWARDNESS
- ❖ OBSOLESCENCE DUE TO RAPID CHANGES IN THE MARKET

# VINBOT SWOT ANALYSIS



## STRENGTHS

- ❖ FINANCIAL RESOURCE AND TECHNICAL KNOWLEDGE BY CONSORTIUM
- ❖ TOTALLY AUTONOMOUS ROBOT
- ❖ SEVERAL PATENTS
- ❖ SUITABLE FOR ANY TYPE OF SOIL
- ❖ SUPPORT BY A LEADING ROBOTIC COMPANY
- ❖ UNIQUE PRODUCT IN THE MARKET

## WEAKNESSES

- ❖ THE ROBOT IS NOT ON THE MARKET YET
- ❖ IT HAS NOT ITS OWN HEADQUARTER AND IT DEPENDS ON THE CONSORTIUM
- ❖ LACK OF HISTORICAL DATA
- ❖ ONLY ONE PRODUCT AT A PROTOTYPE STAGE
- ❖ EXORBITANT SALE PRICES DUE TO COMPLEX TECHNOLOGY
- ❖ FINANCING ARE NEEDED TO KEEP THE PROJECT GOING

## OPPORTUNITIES

- ❖ IT IS OPERATING IN A FAST GROWING MARKET
- ❖ POSSIBILITY TO GET EU'S CONTRIBUTION
- ❖ GROWING DEMAND IN VITICULTURE SECTOR
- ❖ OTHER APPLICATIONS BESIDES VITICULTURE
- ❖ POSSIBILITY TO ENTER IN THE US MARKET

## THREATS

- ❖ COMPETITIVENESS IS EXPECTED TO GROW IN EUROPE
- ❖ SMALL BUSINESSES CAN'T AFFORD VINBOT
- ❖ LACK OF TECHNICAL INFRASTRUCTURE AND LOCAL EXPERTS
- ❖ TECHNOLOGICAL BACKWARDNESS
- ❖ OBSOLESCENCE DUE TO RAPID CHANGES IN THE MARKET

# AGROBOT SWOT ANALYSIS



## STRENGTHS

- ❖ FIRST FULLY AUTOMATED STRAWBERRY HARVESTER
- ❖ IT IS THE FIRST IN US STRAWBERRY MARKET
- ❖ EXTREMELY SAFE ROBOT
- ❖ ONLY ONE PERSON IS NEEDED TO USE THE ROBOT
- ❖ SEVERAL PATENTS
- ❖ ARMS ARE FULLY INDEPENDEND
- ❖ RELATIVELY CHEAP COMPARED WITH LABOR COST
- ❖ COLLABORATION WITH BIG COMPANIES

## WEAKNESSES

- ❖ APPLICATION LIMITED TO STRAWBERRIES
- ❖ THE ROBOT IS STILL AT A PROTOTYPE STAGE
- ❖ IT IS NOT IN COMMERCE YET
- ❖ LACK OF HISTORICAL DATA

## OPPORTUNITIES

- ❖ INCREASING ADOPTION OF AUTOMATION TECHNOLOGIES IN INDOOR FARMING
- ❖ DECLINING AVAILABILITY OF FARM WORKERS
- ❖ INCREASING GOVERNMENT SUPPORT
- ❖ GROWING DEMAND FOR FOOD AND AGRICULTURAL SUPPLY
- ❖ POSSIBLE EXTENTION TO MORE PRODUCTS

## THREATS

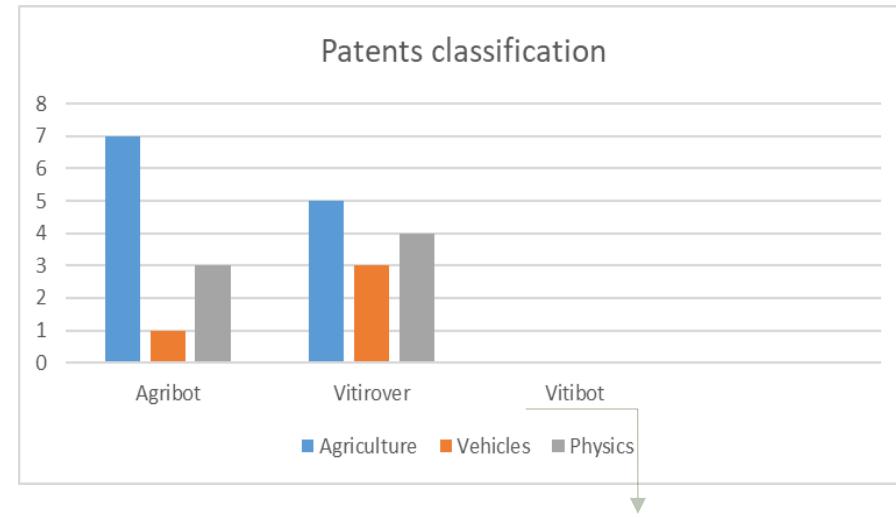
- ❖ COMPETITIVENESS IS EXPECTED TO GROW
- ❖ LACK OF TECHNICAL EXPERTISE AND SLOW ADOPTION TO NEWER TECHNOLOGIES

# COMPETITORS OR PARTNERS ?

PATENTS  
&  
IPC CODE

TECHNOLOGICAL FIELDS

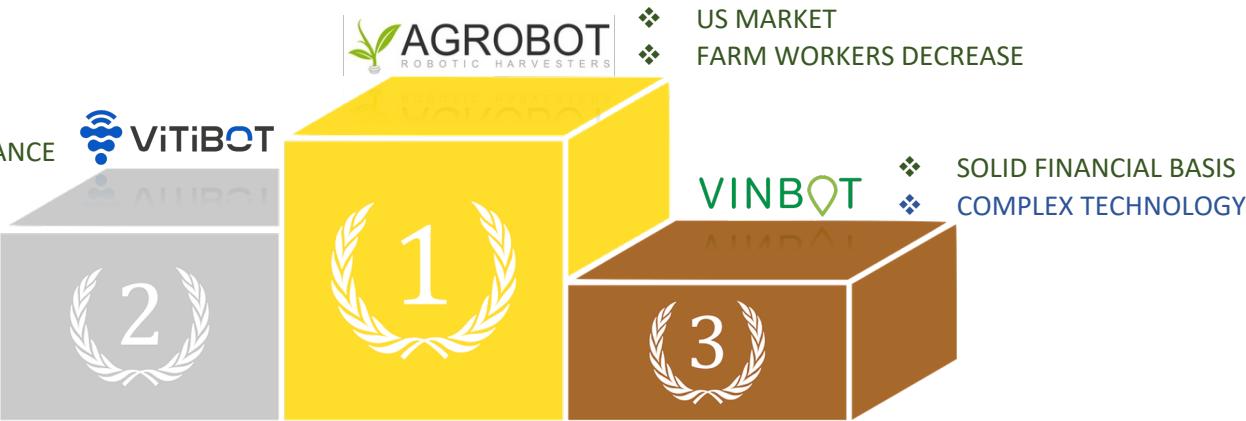
- ❖ AGRICULTURE
- ❖ VEHICLES
- ❖ PHYSICS



PATENTS PUBLISHED BY VITIBOT ARE NOT TO BE FOUND ONLINE. HOWEVER, WE CAN ASSUME A SIMILAR DISTRIBUTION OF VITIROVER (Vitibot)

# DISCUSSION & INSIGHT

- ❖ REMARKABLE PRODUCT
- ❖ FEW COMPETITORS IN FRANCE
- ❖ HIGHLY QUALIFIED TEAM



## COMPETITIVENESS

VITIBOT  
3D VINEYARD IMAGES  
TECHNOLOGY

**VS.**

VINBOT  
SENSORIAL PLATFORM  
TECHNOLOGY

## PARTNERSHIP

VITIBOT **AND** AGROBOT  
COME UP WITH BETTER YIELD FROM  
PRUNING THE VINES, EXPECIALLY THE  
FINEST ONE

# CONCLUSION

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RQ1.  
WHAT ARE THE TECHNOLOGIES  
AND THE **EMERGING APPLICATIONS**  
IN PRECISION AGRICULTURE?  
WHICH **ACTORS, COUNTRIES, ETC.**

**AFFIRMED:** biocides, pesticides,  
sowers, mowers, shakers,  
combined harvesters

**EMERGING:** hydroponic, aquaponic  
Drones, vigor map

RQ2.  
IDENTIFY **COMPETITORS** AND  
**POTENTIAL PARTNERS** OF VITIBOT  
THROUGH *PATENT LANDSCAPE  
ANALYSIS*

- **Deere & Co and Case New Holland**
- **Bear Flag Robotics Inc**
- **Fruitspec LTD**
- **Eleos Robotics INC**

- **Adroit Robotics**
- **Advanced Elemental Technologies**
- **Applied Materials Inc**
- **GrowTech Solutions**

RQ3.  
TO ANALYSE **THREE EMERGING  
STARTUPS** WORKING IN PRECISION  
AGRICULTURE  
SO AS TO UNDERSTAND **THEIR  
POSITIONING IN THE MARKET**, IF THEY  
ARE COMPETITORS, IF THEY  
COLLABORATE OR COULD COLLABORATE



VITIBOT VS. VINBOT

VITIBOT AND AGROBOT

Thank you for your attention